



# **NAVAL POSTGRADUATE SCHOOL**

**MONTEREY, CALIFORNIA**

## **DISSERTATION**

**THE EFFECTS OF SYSTEM DYNAMICS MODELING ON  
SYSTEMS THINKING IN THE CONTEXT OF REGIONAL  
STRATEGIC PLANNING**

by

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September 2014

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THINKING IN THE CONTEXT OF REGIONAL STRATEGIC PLANNING**

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## **ABSTRACT**

This action research case study was intended to qualitatively determine how system thinking and system dynamics modeling informed regional strategic planning and to derive a grounded theory based upon data collected during the Steinbeck Innovation Cluster strategic planning process. Three areas of previous research were investigated: systems, complexity, networks and system dynamics; strategic planning; and industrial clusters. The grounded theory that emerged from my research is that: System thinking and the use of small, system dynamics models can enhance the awareness of decision and policy makers by clarifying dynamic complexity and structure/behavior relationships and may contribute to collaborative, cross-sectoral effort that diminishes the pitfalls of policy resistance in regional strategic planning.

This study contributes to each of the three areas of research already mentioned by addressing perceived gaps at the intersection of systems theory, theories of sustainable cluster development, and theories of strategic planning. Furthermore, this study builds upon previous attempts to evaluate the impact of system dynamics modeling on mental models by qualitatively evaluating pre- and post-intervention responses of actual regional strategic planners from three organizational cross-sectors that included the private sector, the non-profit sector, and the government or civic sector.

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## LIST OF ACRONYMS AND ABBREVIATIONS

Ag	Agriculture
Ag-Tech	Agriculture technology
CapOne	Capital One
CASP	Community Alliance for Safety and Peace
CEO	Chief executive officer
CLD	Causal loop diagram
De-sal	Desalination
FBI	Federal Bureau of Investigation
GED	General education degree
ICT	Information and Communications Technologies
IT	Information technology
K-12	Kindergarten through twelfth grade
L.A.	Los Angeles
MIT	Massachusetts Institute of Technology
MOU	Memorandum of understanding
R&D	Research and development
S/I	Susceptibility/infectivity
STEM	Science technology engineering mathematics
SWOT	Strengths weaknesses opportunities threats
UC	University of California
VC	Venture capital
VoEd	Vocational education

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## **I. INTRODUCTION**

This chapter consists of the following sections: a description of the observed problem, an overview of the three bodies of research covered, a brief description of the case study upon which my research was based, the methodology I employed, and the anticipated contribution of this research to the existing literature.

### **A. THE PROBLEM**

In an increasingly interconnected business and social environment, international organizations, U.S. agencies, regional and multi-national companies continue to pursue a variety of strategic planning methodologies and processes that fail to integrate non-linear feedback mechanisms that could improve the understanding of behavioral outcomes emerging from policies and structures over an extended time horizon.

As an observer of the Joint Staff strategic planning process, I noted that long-term, nonlinear and non-conventional strategic thinking was consistently deferred by senior decision makers. Understanding how those involved in strategic planning in the Department of Defense view concepts of system thinking provides valuable insight for broad applications among interdepartmental and private sector strategic planners who seek to develop strategic plans in a global and interconnected environment. While there are many intergovernmental documents intended to guide senior decision makers in strategic planning, such as the *National Military Strategy*, the *Quadrennial Defense Review*, the *National Security Strategy*, and the *Quadrennial Diplomacy and Development Review*, my reading of these documents indicates little recognition of the systemic nature of the environment. National framing of the strategic environment has essentially remained unchanged since our governmental institutions and planning processes were reconfigured 60 years ago to contain the spread of global communism. In fact, it has been argued that President Eisenhower's Project Solarium was the last successful attempt to systemically address a long range national security strategy (Flournoy & Brimley, 2006). Recognition of the complex and systemic nature of today's strategic environment may be lacking in U.S. government strategic planning, and the

current strategic joint planning process appears to provide little room for outside collaboration with those currently employing system methodologies.

Looking beyond my narrow experience in the Department of Defense, I recognized that the applications of strategic planning extend far beyond the boundaries of the U.S. government and have evolved considerably over the last 50 years. The benefit of understanding the structure and feedback mechanisms of interconnected (and often self-organizing) systems within any bounded environment would seem to be fundamental for strategic planners who hope to achieve desired outcomes while overcoming policy resistance—described by Donella Meadows as several actors working independently to achieve various goals within a system but finding their actions only exacerbate the problems they are attempting to address (1982). Regional planning can be seen as a microcosm of planning at the federal government level, dealing with internal and external economies, community (versus national) security and prosperity, local (versus national or state) education, and the sustainability of local versus national resources. It was for this reason that I chose to study regional strategic planning as the means to better understand strategic planning at the national level.

**My research question was:** *How does system thinking and the use of system dynamics modeling inform regional strategic planning?*

## **B. THREE BODIES OF RESEARCH: SYSTEMS, STRATEGIC PLANNING, REGIONAL CLUSTERS**

Three bodies of research converge to provide an expanded understanding of strategic planning in a regional context. The first body of research deals with system theory in general and a variety of related concepts, including complexity, social and physical network characteristics, chaos, emergence, and system dynamics. The second body of research addresses strategic thinking, sense-making, strategy-as-practice, the evolution of strategic planning, and continuous change. The third body of research seeks to establish the benefits, causes, and characteristics of successful regional clusters. A gap exists, however, in tying these three bodies of research together to explore the impact that

the application of system theory in the strategic planning process may have in the development of successful regional clusters. Taking a step toward closing that gap is the purpose of this dissertation.

## **1. Systems Research**

Our understanding of the physical universe has advanced significantly since the early Age of the Enlightenment (illuminated by Copernicus, Kepler, Galileo, Newton, and Huygens) and the Industrial Age (enabled by scientists such as Bernoulli, Kelvin, Faraday, and Maxwell). The paradigms of certainty and the reductionist approach to understanding cause and effect that characterized these periods were eventually eroded in the nineteenth and twentieth centuries by revolutionary thinkers such as Poincare, Einstein, Bohr, De Broglie, Schrodinger, Heisenberg, Feynman, Simon, Prigogine, Ackoff, Lorenz and others (Zandi, 1986). By the first quarter of the twentieth century, the paradigm of “certainty” had been discarded through a revolution of thought and observation, and a more complex and non-deterministic universe was revealed.

An apparent shift to a focus on the *gestalt* of a system has evolved from the cyberneticists (Wiener, Von Neumann others), the organismic biologists (von Bertalanffy, others), and the system dynamics pioneers (led by Jay Forrester), through design theorists like Herb Simon, and chaos theorists Poincare and Ed Lorenz, to the network and system theorists Strogatz and Watts, Milgram, Barabasi, Capra, and eventually to the complexity scientists Maury Gell-Man, Yaneer Bar-Yam, and others. Throughout this process, an isomorphic mapping has taken place that applies the core concepts of thermodynamics and evolution to emergent behavior in open systems. The isomorphic merging of system science in biology and the understanding of dynamic equilibrium and entropy from thermodynamics formed the basis of new theories of complexity and chaos that introduced the non-linearity of relational behavior in organic and inorganic systems. This approach to understanding complex systems and networks, explored by Granovetter (1985), Strogatz and Watts (1998), Barabasi (2003), Capra

(1996), and many others, was at least partially the result of the next revolution in science, the Information Age. This is particularly significant in the study of complex, non-linear, relationships in human systems.

The trend toward an understanding of complex systems, seems to be reflected in the drift from positivism to post-positivism, from reductionist *analysis* to interpretivist and constructivist *synthesis*—from a focus on physical or “natural science” *components* and *structure* to social, community and networked *behavior* and *patterns*, from a concept of *design* and *control* to the recognition of *emergence* and *self-organization* (Capra, 1996; Zandi, 2000). Perhaps today, Thomas Kuhn would entitle his treatise, “Patterns of Scientific Self-Organization” or “Strange Attractors of Scientific Emergence” rather than “The Structure of Scientific Revolution” (Kuhn, 1962).

Most people can accept that the purpose of science is to describe the structure and constituent characteristics of observable phenomena, perhaps even going so far as to *predict* behavior (through some inductive process of generalization). In other words, describing *what* something does or consists of and *how* it behaves. This is a migration from descriptive explanation to causal explanation. But explaining *why* something happens takes us narrowly close to the abyss of demarcation between science and pseudo-science or metaphysics (Godfrey-Smith, 2003). This involves providing evidence that satisfies the conditionality of causal relationships: that *cause* temporally precedes *effect*; that cause covaries with effect; and, that no alternative explanations are plausible (Shadish, Cook, & Campbell, 2002). A logical (though not, perhaps, necessarily practical) outcome of this is an expectation of *predictability* and *testability*. The value of theory, many would contend, lies in its explanation of observed phenomena. According to Kerlinger and Lee (2000), “By its very nature, a theory predicts.”

However, the predictability and testability of theory in a complex and non-linear environment that is characterized by uncertainty and chaotic behavior—behavior that is the result of non-linear dynamics creating deterministic, though non-repeating and largely non-predictive behavior—may now be secondary to the importance of increasing our understanding of causal relationships that are often far removed in time and space. System dynamics practitioner, John Sterman stated, “The heuristics we use to judge

causal relations lead systematically to cognitive maps that ignore feedbacks, multiple interconnections, time delays, and the other elements of dynamic complexity” (2000, p. 28). He went on to assert that “...people use various cues to causality including temporal and spatial proximity of cause and effect, temporal presence of causes, covariation, and similarity of cause and effect...These heuristics lead to difficulty in complex systems...” (Stermann, 2000, p. 28). This process of sense-making has a direct bearing on strategic thinking and planning.

## **2. Strategic Thinking/Planning**

There is a body of research related to the strategic application of systems thinking, complexity theory, and complex and adaptive systems theory to strategic planning in business and a variety of organizational constructs. This research includes, for example, analyses of the strategic planning process (Armstrong, 1982; Mintzberg, 1994), strategy-as-practice (Whittington, 1996), complexity in strategic change (Stacey, 1995), oil firms’ strategic planning for unpredictable change (Grant, 2003), open systems and strategic planning (Jackson & Keys, 1984), backcasting for strategic planning of sustainable development (Holmberg & Robert, 2003), cognitive biases on strategic planning (Barnes 1983), complex and adaptive system of systems engineering and modeling (Glass, Brown, Ames, Linebarger, Beyeler, Maffitt, Brodsky, & Finley, 2011), and, strategic planning in small firms (Robinson & Pearce, 1984). The benefit of understanding the complex nature of the environment would seem to be fundamental for strategic planners whose organizations are systemically part of this environment. Further research is needed, though, in analyzing the potential benefit of employing methods of system thinking and complexity in the deliberate planning of regional and global strategies.

A primary objective of strategic planning is to inform decision makers of the complexity of the environment in which they, and their competitors, operate and to broaden the horizon of their strategic thinking. Research in the areas of complexity and systems thinking covers a spectrum of concepts that frame regional and global environments, ranging from linear and deterministic approaches to predictability, to probabilistic constructs of complexity, chaos, bounded instability, and emerging systems.

Common in much of this analysis is a focus on determining system boundaries, endogenous and exogenous impacts, identification and implementation of feedback loops, and an appreciation of the delays and time frames required to provide a sufficient understanding of relationships within and between systems. An efficacious strategic planning process must be focused on enhancing the ability of decision makers to make sense of an uncertain and complex environment. One tool that could prove useful in this process is system dynamics modeling, created by Jay Forrester at Massachusetts Institute of Technology (MIT) (Forrester, 1958).

Kurtz and Snowden (2003) assert that “organizations settle into stable symmetric relationships in known space and fail to recognize that the dynamics of the environment have changed until it is too late” (p. 475). The concepts of system dynamics provide for the setting of boundaries and the analysis of endogenous systems in terms of the stock (quantities of material), flow (the rates at which these systems change), positive (self-reinforcing) and negative (self-correcting) feedback loops inherent in goal-seeking systems, and the delays associated with these interactions (Sterman, 2000). By understanding the structure of these feedback loops, it may be possible to maintain the desired dynamic equilibrium of system behavior required to achieve or sustain stability amidst uncertainty. Nowhere is this more evident than in the area of regional planning for economic development and growth, where local governments, commercial interests and social services seek to leverage geographic propinquity/proximity and social networks to create centers of sustainable prosperity.

### **3. Regional Clusters**

Noted Harvard economist, Michael Porter, championed the notion of regional clusters that provide the means for bringing together firms and institutions (including investment, science and technology policy, technical and vocational training, and infrastructure) and identifying impediments and constraints to productivity, specifically linking the concept of clustering to the flow of information and innovation. Porter (1998) also recognized the role social networking plays in forming viable clusters and eventually defined clusters as “a geographically proximate group of interconnected companies,

suppliers, service providers and associated institutions in a particular field, linked by externalities of various types” (Porter, 2003, p. 562). The phenomena of geographic proximity and homophily (connectivity through shared interests) have also been explored in social network theory (Kadushin, 2012).

For purposes of my research, I have chosen to use the term “regional-” or “industrial-” cluster, which, based on the literature, includes aspects of an “industrial commons” (Shih & Pisano, 2009) with greater emphasis placed on the network characteristics of a cluster. What is apparent from the existing literature is that strategic planning in the business community pays little explicit attention to the network and system aspects of industrial/regional clustering that would allow them to be successfully modeled. Specifically, factors, variable constraints, and relationships are seldom viewed within a traditional network context, and when social networking (clustering, hubs and linkages) or elements of system theory (feedback loops) are cited, there is little reference to the modeling methodologies of system dynamics (causal relationships between stock/hubs, relationships/links, productivity/flow, or behavior patterns/feedback). My research was intended to make this linkage explicit.

### **C. CASE STUDY BACKGROUND**

In early 2012, the Mayor of Salinas was confronted by a moribund local economy. Gang-related violence was deterring investment, there was insufficient employment opportunity for local residents, and this was exacerbated by a growing youth bulge that resulted from a largely Hispanic migrant farm-worker population. Water scarcity and restrictive water management policies made agricultural growth and sustainability a constant challenge, with farmers, ranchers, and vintners sharing diminishing sources of water. The riverine system that had historically been the indigenous environment of fresh water flora and fauna—and that had provided recreation for local communities as well as irrigation for farms and ranches—was now largely dry and barren. State and local regulations, taxes, and energy costs deterred new business development, and contributed to the stagnant job market, further decreasing area attractiveness for new home development and construction. The historic city center,

characterized by empty store fronts and slumping small businesses, sat in direct proximity of the beautiful and modern Steinbeck Museum, an ironic and haunting juxtaposition of promise amid near depression-era misery. The local kindergarten through twelfth grade (K-12) school system offered kids little real hope of meaningful employment or academic futures despite being located in the heart of America's "Salad Bowl," 30 miles from the technological epicenter of Silicon Valley, and a short drive from a number of quality universities and state colleges. Local area youth, recruited and pressured by gang members, often entered the sagging service sector, working in local hotels and restaurants, while many of their parents labored in the fields or struggled with local businesses.

In January of 2012, a consulting group that had been commissioned by the city of Salinas to explore an economic development strategy delivered its findings. The study found that:

Salinas and the surrounding region possess some powerful characteristics, [that] if strategically positioned, would allow it to become the nexus of technology and agricultural production addressing the 21st century demands for food safety, food security, and environmental protection and energy efficiency. This strategy could result in the creation of enhanced technologies, products, and most importantly, jobs and economic revival for the City of Salinas and surrounding region. However, this can only be achieved with the development of a clear vision and ambitious strategic plan that would contribute to the economic recovery of the region and potentially the entire state of California. (Hatamiya 2012, p. 4)

In a meeting with Mayor Donohue that same month, I mentioned that this report was consistent with concepts described in the *Harvard Business Review* article entitled, "Restoring America's Competitiveness," that argued the need for industrial commons in the United States, and a body of work assembled by Harvard economist Michael Porter, and others, that described the characteristics of successful industrial clusters worldwide (Porter 1997, 2003; Shih & Pisano, 2008).

Then, in the spring of 2012, the area's largest single employer, Capital One, announced the closing of its Salinas facility, which would eventually add another 800 skilled workers to the unemployed labor pool in a stagnant job market. The Mayor of



Salinas assembled a working group that consisted of prominent local area business leaders, city council members, shippers, growers, ranchers, and vintners, academics, bankers, and a technology investment consultant from Silicon Valley. This group was convened in a plenary approximately once a month. I was invited to be part of a smaller board, consisting of the mayor, the city planner, the Silicon Valley consultant, a public relations consultant, and two prominent business women representing large commercial farms and wineries that met on a weekly basis. Details of this process can be found in Appendix A.

The mayor identified two objectives for the working groups he had assembled: in the near term, they were to develop a plan that could immediately address the impact of losing Capital One as an area employer; over the long term, the mayor wanted to develop a strategy, consistent with the report's findings, that would facilitate sustainable economic growth, while addressing the challenges facing his city and the region. Loosely based on an unpublished paper I had written (Porter, 2012), a long term strategy began to take shape that leveraged regional characteristics of successful industrial clusters: a focused economic competency (agriculture and aquaculture); the research and educational foundation found in several local colleges and universities; the co-location of capital investment and technological expertise in Silicon Valley; the municipal and regional support of local agricultural associations (shippers and growers, ranchers, wine industry); and the availability of a potentially highly skilled labor pool. The coalescing strategy would be based on addressing energy, water and waste management, by pursuing the technology required to support "precision agriculture / aquaculture" (remote sensing, robotics, real-time monitoring of resources, big data storage and analysis, advanced processing and shipment of crops) as a manufacturing base. In essence, the formulation of an industrial cluster focused on the technology of "smart farming." Over time, the smaller working group was formalized as a 501c3 for public benefit and was named the Steinbeck Innovation Foundation ([www.steinbeckinnovation.org](http://www.steinbeckinnovation.org)). It was decided by this group that the strategy could be well served by the development of system dynamics models to better understand the regional dynamics that could inform strategic decision making and policy development.

#### **D. METHODOLOGY**

Reason and Bradbury wrote that action research is “a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory world-view” (2003, p. 156). They explain that action research is intended to bring together theory and practice to find practical solutions of concern to individuals and their communities. Furthermore, it should be grounded in lived experience, developed through partnership and intended to address significant problems by working with the people involved rather than simply studying them. Action research is intended to develop a new way of seeing/theorizing the world in order to both implement and influence the creation of policies (Bradbury & Reason, 2003).

Having been asked by the Mayor of Salinas, California to help develop a strategy for economic development under challenging socio-economic, cultural, and physical resource constraints, I recognized an opportunity to employ action research that could inform the development of theory in the use of system thinking and methodologies for strategic planning while improving the quality of life of a community’s residents. It is hoped that by examining regional strategic planning at the city and county levels, some generalizations may apply to national, or “grand,” strategic planning at the federal level. This case study aims to use the epistemic approach of action research to address a perceived gap in previous research by answering the research question, “How does system thinking and the use of system dynamics modeling inform regional strategic planning?”

#### **E. ANTICIPATED CONTRIBUTION TO THE LITERATURE**

My anticipated contribution to the existing literature lies in the convergence of the three bodies of research cited—system methodology, the strategic planning process, and the development of regional clusters—by closing the knowledge gap that exists in better understanding how aspects of each can be explicitly combined through system dynamics modeling to enhance long term sense making of policy makers engaged in regional strategic planning.

## **II. LITERATURE REVIEW**

The three areas of previous research that were explored to provide an expanded understanding of strategic planning in a regional context were system sciences, strategic planning, and industrial or regional cluster development.

### **A. SYSTEMS, COMPLEXITY, NETWORKS, AND SYSTEM DYNAMICS**

Over the last decade our understanding and appreciation of network and system theories and the mechanisms of self-organization have been greatly informed by the work of Barabasi, Capra, Strogatz and Watts, Granovetter, and Lewis. As a disciple of system dynamics and system thinking in business, Senge asserts, “Today, systems thinking is needed more than ever because we are becoming overwhelmed by complexity” (2006, p. 69). He discusses system theory as a “discipline for seeing wholes,” patterns of behavior rather than snapshots (Senge 1990, 2006, p. 68). In later work, Capra and Barabasi build upon these concepts (Barabasi, 2003; Capra, 1996). Capra (1996) explains that in this century we are experiencing a change from a “mechanistic, reductionist, or atomistic” paradigm to a holistic, organizational, or ecological paradigm. He maintains that systems thinking—“in terms of connectedness, relationships, context”—takes us a step closer to understanding complex structures and behaviors. He goes on to state, “In the systems view we realize that the objects themselves are networks of relationships, embedded in larger networks” (p. 37). Capra elaborates on non-linear networks by exploring the properties of self-organization in which ordered patterns spontaneously emerge in open systems operating far from equilibrium.

The biologist Ludwig Von Bertalanffy, perhaps influenced by concepts developed in the 1940s by the cyberneticists, revisited earlier work of his own to offer a general system theory (Von Bertalanffy, 1951). Von Bertalanffy recognized that all scientific constructs are models representing certain aspects or perspectives of reality. He espoused an organismic viewpoint: the theory of open systems and steady states as an expansion of conventional physical chemistry, kinetics, and thermodynamics, which led to his general systems theory (Richardson, 1991). Von Bertalanffy asserted that the goals of general

system theory are reflected in cybernetics, information theory, game theory, decision theory, topology, factor analysis, and general system theory or systems science (1962; Buckley, 1968). More recently, the isomorphic merging of system science in biology and the understanding of dynamic equilibrium and entropy from thermodynamics formed the basis of new theories of complexity and chaos that introduced the non-linearity of relational behavior in organic and inorganic systems (Ackoff, 1981; Prigogine & Stengers, 1984; Simon, 1996). This approach to understanding complex systems and networks was explored by Granovetter (1985), Strogatz and Watts (1998), Barabasi (2003), Capra (1996), and many others, and was at least partially the result of a twentieth century revolution in science, the Information Age.

Barabasi built upon the work done by Strogatz and Watts at Cornell and Granovetter at Harvard that explored the phenomena associated with synchronicity, clusters, and the small world phenomenon (Barabasi, 2003; Granovetter, 1973; Strogatz & Watts, 1999). Barabasi's work in analyzing the architecture and behavior of the Worldwide Web, contributed significantly to the understanding of emergence and self-organization in complex systems, specifically related to power law distributions first pioneered by the mathematician Pareto (Koch, 1998). Pareto's law, which has come to be known as the 80/20 rule, has since formed the basis of a body of research related to the self-organization of emerging systems / networks. Ted Lewis (2011) further explored the application of the power law as "networks evolve from random to clustered and eventually scale-free networks" through percolation, preferential attachment, clustering, and the formation of hubs (p. 121). The developing science of systems and network theory contribute directly to our understanding of emergence in regional clusters.

Much of the literature that relates complexity, uncertainty, and system thinking to strategic planning focuses on three major areas of study: making sense of a turbulent environment for decision makers; the application of system dynamics and theories of complexity, chaos and emergence to the global environment; and, the evolution of the strategic planning process for large companies and organizations. The concepts of system dynamics provide for the setting of boundaries and the analysis of endogenous systems in terms of the stock (quantities of material), flow (the rates at which these systems change),

positive (self-reinforcing) and negative (self-correcting) feedback loops inherent in goal-seeking systems, and the delays associated with these flows (Sterman, 2000). By understanding the mechanisms of these feedback loops, it may be possible to maintain the desired dynamic equilibrium of a system required to achieve or maintain stability. Complicating this effort are the dynamics inherent in complex systems and chaotic behavior that create instability, particularly in boundary areas between systems. Emergent patterns develop in what is commonly referred to as the edge of stability or the edge of chaos, and complexity can enable useful emerging patterns (Kurtz & Snowden, 2003).

In their study of radical versus continuous change in an organization, Plowman, Baker, Beck, Kulkarni, Solansky, and Travis describe complex systems as being characterized by the non-linear feedback interactions of their components. Drawing a distinction between continuous change and radical change, the authors describe four constructs from complexity theory they find essential to emergent behavior and a better understanding of continuous and radical change: (1) initiating conditions, (2) the far-from-equilibrium state, (3) deviation amplification, and (4) fractals and scalability (Plowman, Baker, Beck, Kulkarni, Solansky, & Travis, 2007). First explored by the mathematician Benoit Mandelbrot, fractal dimensions describe mathematic, non-Euclidean self-similar geometric structures that are replicated at varying scales (Mandelbrot & Blumen, 1989). Fractals have become closely related to the non-repeating patterns in chaos theory (Gleich, 1987). Plowman et al. explain:

Applied to organizations, the concepts of fractal patterns and scalability mean that, as in nature, similar patterns appear at various levels—the individual, group, and organizational... which suggests that emergence occurs in the same pattern across stages or levels in an organization. (p. 521)

As a result of their study of radical change within a church organization, the authors concluded that the dynamic conditions under which initial change occurred lent itself to emergent behavior that could eventually lead to unintended radical change (Plowman et al. 2007).

It is important, however, to recognize that not all systems and behaviors are complex. In their study of sense-making in a complex and complicated world, Kurtz and

Snowden (2003) discuss the human tendency to use patterns to make sense of complex situations. They submit that in a dynamic and constantly changing environment, it is possible to pattern un-order, but not to assume order. Kurtz and Snowden emphasize things are both ordered and un-ordered at once, because in reality order and un-order intertwine and interact. The distinction made here, is that “un-order” is not the lack of order, but is paradoxically a contrast between ordered systems that can be derived from empirically verifiable rules and a different sort of order in which the whole is never simply the sum of its parts (Kurtz & Snowden, 2003). This reflects a growing awareness of the concept of gestalt in understanding system behaviors. While ordered systems lend themselves to design, un-ordered systems are emergent, resulting from the dynamic interactions of entities through time and space. A critical question for strategic planners is whether agents in a changeable system are free to choose outcomes of strategy or whether their choices are driven by the nature of the environment? Organizations are themselves systems within larger environmental systems that are so complex “futures emerge unpredictably from the interactions between agents in conditions of non-equilibrium and disorder” (Stacey 1995, p. 479). This may be the challenge for strategic planners operating in a turbulent environment that is subject to random shocks.

In attempting to raise the awareness of decision makers, planners are confronted by universal assumptions, cognitive and judgmental biases that obstruct long term vision. Kurtz and Snowden assert that “senior decision makers and their policy advisors will always find ways of fitting their reality into existing models rather than face the facts that those models are outdated” (p. 476). Three assumptions that become dangerous in a complex and uncertain environment are the assumption of order and causal links, the assumption of rational choice to minimize pain or maximize pleasure, and the assumption that actions from competitors, populations, nation states, communities or whatever are the result of intentional capability or behavior (Kurtz & Snowden, 2003). Kahneman and Tversky found that when confronted by uncertainty, people often use heuristic principles in order to simplify complex problems, but these overly simplistic heuristics can lead to significant systematic errors in judgment. Perhaps the most common among these are representativeness bias, availability bias, and adjustment and anchoring, which include a

variety of heuristic biases associated with misconceptions, misunderstandings, or misapplications of probability, regression, and statistical analysis (Tversky & Kahneman, 1974).

Barnes identifies several judgmental biases that often obscure the view of decision makers and planners alike. Availability is a bias in which people judge the likelihood of a future event if instances of it are easy to imagine or recall. Hindsight bias results when knowledge of “an event’s occurrence increases that event’s inevitability.” The misunderstanding of the sampling process leads to bias resulting from overconfidence in too small a sampling of data. Overdependence is a bias based on correlation between variables that can create the illusion of cause and effect, particularly where a panel of experts is used for forecasts. Representativeness bias leads to the conclusion that “an outcome is highly representative of the process from which it comes” (Barnes, 1983, pp. 130-131). Finally, Grant cites the work of Hamel in his discussion of strategic inertia, identifying a “conservative bias” in which top management teams are characterized by a lack of genetic diversity and emotional equity in the past. It is contended that, “Breaking the conservative bias of strategic planning may require involving younger organizational members who are further from corporate headquarters” (Grant, 2003, p. 494, Hamel, 2000).

The science, or art, of system dynamics was pioneered by Dr Jay Forrester in the 1960s, primarily as the means to better understand the dynamic behavior of complex systems with applications for corporations. John Sterman (2000) describes system dynamics as being based upon the theories of non-linear dynamics and control theory that had emerged from the hard sciences of mathematics, physics, and engineering but adds that, “Because these tools are applied to the behavior of human as well as physical and technical systems, system dynamics draws on cognitive and social psychology, economics, and other social sciences” (p. 5). Stacey explains that the science of complexity is concerned with the fundamental logical properties of the behavior of nonlinear and network feedback systems. Human systems are then influenced by feedback loops affected by both free choice and constraint. He cites work by Forrester and Senge that found “the circular feedback nature of choice, action, and outcome leads

to a complex connection between cause and effect” (Stacey, 1995, p. 480). In a bounded system, the application of system dynamics can provide both conceptual and qualitative insight.

Sterman explains that much of the art of system dynamics modeling is discovering and representing feedback processes, which along with stock and flow structures, time delays, and nonlinearities, determine the dynamics of a system. He asserts that, “System dynamics is a powerful method to gain useful insight into situations of dynamic complexity and policy resistance,” a phenomenon in which unintended consequences arise from overly simplistic fixes for complex problems (Sterman, 2000, p. 39). Donella Meadows argues that the power of system dynamics is the discovery of leverage points within a given system (1999). Stacey (1995) maintains that, “When a nonlinear feedback system operates at the edge of instability,” agents in that system cannot intend the long term outcomes of their actions, which emerge from the detailed interactions between agents and can result in chaotic behavior (p. 482). Taken together, concepts of system dynamics, complexity, chaos, and emergence can form a more complete understanding of an uncertain and turbulent environment.

When considering human systems and organizations within the environment, it is important to gain an understanding of how to model agents or stakeholders, where to draw the boundaries of the system, and over what span of time to project system behavior. Kurtz and Snowden point out that in a human complex system, an agent is anything that has identity, and therefore can be modeled as individuals or groups. They lament that “We would like (but do not expect) to see simulations of human behavior able to encompass multiple dynamic individuals and collective identities representing all aspects of perception, decision making, and action” (Kurtz & Snowden, 2003, pp. 464–465). Sterman discusses boundary selection for system dynamics modeling in terms of articulating a specific problem to be modeled, identifying key variables and concepts, determining the proper time horizon (forward and backward, usually several times the duration of the longest delay), and considering past and possible future behavior of key variables (2000).



System dynamics provides the methodology and tools to analyze specific problems by endogenously modeling the causal relationships between stock (accumulation), flow (transfer of stock), and feedback loops that self-reinforce (positive) or self-correcting, goal-seeking systems. Inherent in this process are delays associated with the accumulation and depletion of stocks. The behavior of a system, then, arises from its feedback loops, stocks and flows, and nonlinearities created by the interaction of the physical and institutional structure of the system with the decision making processes of the agents acting within it (Sterman, 2000). While the detailed process of system dynamics modeling exceeds the scope of this study, it is important to recognize that it is simply one tool, and one frame of reference, that can be applied to the analysis of organizational and environmental systems. A greater understanding can be gained by considering the types of systems that interact in a strategic environment. These systems include simple and relatively linear systems, complex and chaotic nonlinear systems, and the emergent behavior that arises in the boundaries between these systems (Stacey, 1995). When considering the dynamics of system behavior, it is also critical to identify the nature of the systems themselves - whether they are open or closed, deterministic or probabilistic. Jackson and Keys site the work of Ackoff who used the terms “machine age” and “systems age” to refer to eras, which demonstrated two different system types. According to Jackson and Keys:

The machine age was concerned with simple systems which were closed and that could be understood using the reductionism of traditional scientific methods, while the system age is characterized by complex systems that are open, only partially observable, and cannot be understood by methods of reductionism. (1984, p. 476)

The accumulation and flow of stock within a given system can vary considerably from material resources and funding, to human labor, production and even knowledge. For example, Nissen (2006) maintains, “The economics of knowledge stocks and flows can relate factors such as substitutability and imitability to knowledge flows such as time compression diseconomies and mass efficiencies” (p. 228). System dynamics seeks endogenous explanations for behavior - the dynamics of a system through the interaction of the variables and agents represented in the model (Sterman, 2000). It is therefore

important to understand that in system dynamics, drawing the boundaries of the system too widely will only confuse the effort and further complicate the analysis. As strategic thinking expands beyond the models of system dynamics, the notion of boundaries takes on an even broader importance. Kurtz and Snowden (2003) stress that, “Boundaries are possibly the most important elements in “sense-making,” because they represent differences among or transitions between the patterns we create in the world we perceive” (p. 474).

System dynamics modeling is perhaps most useful in addressing three aspects of complex, non-linear systems. These three concepts can be labeled dynamic complexity, policy resistance, and structure/behavior relationships. Dynamic complexity arises in systems through the interaction over time of feedback loops among constituent agents or components within the structure of system. Delays inherent in this interaction exacerbate the combinatorial complexity of behavior among agents, often defying the decision maker’s ability to find direct links of causality in both time and space proximity. Policy resistance results from the misunderstanding of dynamic complexity leading to attempted solutions that actually contribute to or accelerate the problematic behavior of the system. The relationship between system structure and non-linear behavioral outcomes is the essence of system dynamics, in which modeling and simulation is used to enhance the understanding of feedback mechanism within the system structure that often result in non-intuitive outcomes over time (Sterman, 2000). These three concepts are fundamental to better understanding and managing complex systems such as those represented in regional clusters discussed later in this chapter.

Not surprisingly, the method by which to measure the impact of dynamic modeling on mental maps used in decision making has been the subject of a number of studies. Much research is focused on measuring the impact of employing various methodologies of collaborative system dynamics modeling on study participants individually and in groups (Ackermann, Andersen, Eden, & Richardson, 2010; Rouwette, Vennix, & van Mullekom, 2002; Rouwette, Korzilius, Vennix, & Jacobs, 2011; Snabe 2007). In analyzing several case studies of different organizational approaches to group model building, Rouwette, Vennix, and van Mullekom discussed the need to limit

organizational characteristics to structure, type and size, further identifying three type subdivisions as Profit, Non-Profit and Governmental (2002). Generally, the assessments of impact focus on quantitative measurement and statistical analysis (Doyle, Radzicki, & Trees, 1998; Rouwette et al, 2002; Schaffernicht & Groesser, 2011). Schaffernicht and Groesser, building upon previous work done by Forrester, Doyle and Ford, and others, observed that developing and comparing more comprehensive and dynamic mental models can systematically lead to a better understanding of their variables and underlying structures. The methodology they propose involves an analysis of model distance ratios, loop distance ratios, and element distance ratios between existing mental models and system characteristics not previously considered (Schaffernicht & Groesser, 2011).

More than 10 years earlier, Doyle, Radzicki, and Trees (1998) asserted in an unpublished report that, “Changing the mental models of participants to make them more complete, complex, and dynamic is one of the primary goals of interventions based on systems thinking, management flight simulators, or system dynamics model building” (p. 3). While they allow for operational differences in approach, they go on to advocate for a number of goals that need to be achieved in order to measure change in mental models. Among these goals is the need for experimental control, the need to separate measurement and improvement, the collection of detailed data from individuals in isolation, the need to measure actual change versus perceived change, gathering quantitative measures of mental model characteristics, and obtaining sufficient statistical power (Doyle et al, 1998). The methodologies of these studies, and those they reference, are highly dependent on quantitative, statistical analysis to offset subjectivity and bias on the part of the researcher. There is a perceived gap in this research methodology that accommodates qualitative assessments, particularly in the context of action research.

The limitations of system dynamics, as described by Stacey, reside in the assumption that successful systems are regulated by negative feedback processes that drive systems toward equilibrium, stability, and predictability. These assumptions are now being questioned by “the science of complexity,” which is concerned with fundamental logical properties of the behavior of nonlinear and network feedback systems (Stacey, 1995). Closely related to complexity is the concept of chaos. Sterman

removes much of the ambiguous jargon associated with the term “chaos,” by explaining it in terms of irregular, non-repeating oscillation. He points out that chaotic systems have the property of sensitive dependence on initial conditions, and because two nearby trajectories will diverge exponentially, the prediction horizon for chaotic systems is likely to be short (Sterman, 2000). According to Stacy, “This ‘sensitive dependency’ on initial conditions means that, for all practical purposes, links between specific causes and effects, specific actions and outcomes, are lost in the complexity of what happens” (Stacey, 1995, p. 483).

The notion of emergence is derived from systems that operate in the oscillating chaotic state between stability and instability, between equilibrium and disequilibrium. Kurtz and Snowden (2003) discuss the kind of order “in which no director or designer is in control but which emerges through the interaction of many entities” (p. 464). The concepts of complexity and the related theories of chaos and emergence provide a much broader context within which to conduct strategic planning, particularly with applications for regional clusters. While system dynamics modeling is not intended to address emergent structures, it is valuable in understanding emergent behavior from the feedback mechanisms at play within existing structures. The use of system dynamics in strategic planning has yet to reach its full potential in allowing decision-makers to make better sense of behavior that can result from complex system structures. This is particularly relevant in addressing dynamic complexity, structure/behavior relationships, and policy resistance.

## **B. STRATEGIC PLANNING**

Strategic planning has evolved over the past several decades in response to what is recognized as an increasingly uncertain and turbulent global environment. As will be discussed, less emphasis is now being placed on developing specific plans of actions for corporate control. Rather, the focus of strategic planning has shifted to enabling adaptability through increased environmental awareness and strategic thinking. This has resulted in less formal processes of strategic planning with greater appreciation for creativity and innovation in the development of alternative future scenarios to enable

flexibility in the face of uncertainty. Strategic planning can serve a spectrum of enterprises and organizations, from sports teams and small businesses to multi-national corporations, militaries and national governments. First, it is necessary to gain an understanding of what is meant by “strategic planning.”

Perhaps a good place to start is to consider what strategic planning is *not*. Mintzberg (1994) opines that “strategic *planning* is not strategic *thinking*” and writes, “Strategic planning, as it has been practiced, has really been strategic programming, the articulation and elaboration of strategies, or visions that already exist” (p. 107). In this sense, many view strategic planning less as the articulation of a long term vision than as the means to achieve objectives through deliberate actions and communications. In his study of the use of strategic planning by major oil companies, for instance, Grant (2003) found the emphasis of intent was not on the development of strategies, per se, but on “the mechanisms for improving the quality of strategic decisions, for coordinating strategic decision making, and for driving performance improvement” (p. 512). The purpose of strategic planning should not then be confused with the development of a mission statement, which describes an organization’s vision and values. Though considered by some to be part of the overall strategic planning process, the definition of an organization’s purpose and direction, stakeholder analysis, the formulation of mission, the identification of fundamental values and environmental assessments must precede the actual development of strategy (Bryson, 1988). Strategic planning is not then the formulation of an overarching vision but the means to achieve it. Strategic planning is *informed* by strategic thinking.

In exploring the field of strategy research, Whittington (1996) sought to develop an approach that joined academics and practitioners in what he called strategy-in-practice in an attempt to answer the question, “what does it take to be an effective strategy practitioner?” (p. 731). In his work, Whittington described a progression from a planning approach to strategy in the 1960s to a policy approach in the 1970s and a process approach in the 1980s, shifting concern from the “core competence of the corporation to the practical competence of the manager as strategist” (p. 732). This analysis was consistent with later work done by Grant in his study of the evolution of strategic

planning in oil majors, discussed later in this section (2003). The thrust of Whittington's argument rests on the conviction that effective strategists, rather than organizations, must not only know about the analytical techniques of planning, policy and organizational processes, they must draw on the skills and knowledge inherent in the actual practice of strategy-making (Whittington, 1996).

Strategic planning is often seen as the link between thought and the actions that must be taken to achieve specific objectives. Bryson (1988) states that, "...strategic thought and action are increasingly important to the continued viability and effectiveness of governments, public agencies and non-profit organizations of all sorts" (p. 74). In a review of 12 studies that examined approaches to strategic decision making by corporate planners, Armstrong (1982) found that formal planning required "an explicit process for determining the firm's long-range objectives, procedures for generating and evaluating alternative strategies, and a system for monitoring the results of the plan when implemented" (p. 2). In the end, strategic planning is seen as enabling strategic decision making. One definition of strategic planning that seems to broadly, and aptly, apply to all organizations was cited by Bryson and is attributed to Olsen and Eadie: "It is a disciplined effort to produce fundamental decision and actions shaping the nature and direction of an organization's (or other entity's) activities within legal bounds" (Bryson, 1988, p. 74). For the purposes of this study, this description provides a broad enough definition from which to analyze the strategic planning linkage between strategic vision and the development of strategies to achieve specific objectives consistent with that vision.

In his study of oil majors, Grant found that in response to macroeconomic disequilibrium, exchange rate volatility, the emergence of newly industrializing countries and the inability to predict demand and prices among other variables, over the last two decades, major oil companies have had to reconcile systematic strategic planning with turbulent, unpredictable business environments. Uncertainty required strategy to be concerned less with specific actions and more with establishing clarity of direction and short term flexibility (Grant, 2003). Barnes (1983) echoes that by concluding that the search for certainty is legitimate if it is done consciously, if the remaining uncertainties

are acknowledged rather than ignored, and if managers realize the cost. In this context, it can be seen that raising the awareness of decision makers and broadening their appreciation of the uncertain environment becomes a critical consideration for strategic planners. Mintzberg points out that planners not only have time and certain techniques to focus their efforts, they have the inclination to do analysis. Because of time pressures, managers tend to favor action over reflections, which can cause them to overlook analytical inputs. Planners can encourage strategic thinking and strategic acting (Mintzberg, 1994).

Mintzberg and others believe the very labeling of the activity “planning” lends a formalization that obstructs creativity and free thinking rather than encouraging it. With regard to the process of strategic planning therefore, Mintzberg (1994) concludes that, “Formal procedures will never be able to forecast discontinuities, inform detached managers, or create novel strategies” (p. 111). In his study of major oil companies, Grant noted a trend, in response to market and environmental turbulence over the last several decades, away from forecasting and prediction and towards the development of alternative scenarios that demanded a less formalized process for strategic planning. He found that complexity theory provided the bridge between strategy-as-design and strategy-as-process, with bottom-up strategic planning proving to be more conducive to incremental adaptation. Corporate guidelines provided a mere framework of constraints and objectives that broke down long term goals into short term objectives—strategic planning became less about the strategic decision maker and more about coordination and performance managing (Grant, 2003).

The evolution of the strategic planning process experienced by oil majors over the last several decades described in Grant’s study provides an excellent example of large, hierarchical organizations attempting to better understand a turbulent and uncertain environment. Just as many objectives and processes are common to most strategic planning, so too has been the awareness of a changing environment and the increasing difficulty of attempting to predict or forecast future events. Such an evolution seems reasonable when considering that “organizations are nonlinear, network feedback systems, themselves, and it follows logically that the fundamental properties of such

systems should apply to organizations” (Stacey, 1995, p. 481). Armstrong (1982) found that strategic planning calls for an examination of the complete system that includes stakeholder analysis in the development of objectives. Mintzberg (1994) discusses the need for planners to appreciate informal and visionary processes he refers to as “soft analysis.” He explains that, “Soft analysis suggests an approach in which it is more important to pose the right question than to find the precise answer” (p. 23).

According to Grant, interest in strategy as an area of management study followed the diffusion of strategic planning (long-range planning) among large companies in the 1950s and 1960s. He explains that by the 1980s, empirical research in strategic planning systems focused first on the impact of strategic planning on firm performance and the role of strategic planning in strategic decision making, and a second area of research explored organizational processes of strategy formulation. The challenge of making strategy when the future is unknowable encouraged reconsideration of both the processes of strategy formulation and the nature of organizational strategy, so that “in response to increasing environmental turbulence, strategic planning systems have changed substantially from the highly formalized processes of the 1960s and 1970s” (Grant 2003, p. 494).

While many, chief among them Mintzberg, argue that formal strategic planning can stifle creativity and innovation, there is almost universal agreement that the elements required for strategic planning include the development of goals and objectives, assessments of internal and external factors that impact the environment and behavior of agents, an appreciation for stakeholder interests, and the means to gain alignment with and a commitment from higher management. Bryson offers an eight step, iterative process intended to assist key decision makers that reflects commonly accepted elements of strategic planning. These eight steps include agreement upon composition of the planning team, a clear understanding of the mandate, clarification of the mission and stakeholder analysis, an external assessment of opportunities and threats, an internal assessment of strengths and weaknesses, strategic identification of what can reasonably be achieved, strategy development, and description of the organization’s future (Bryson, 1988). Another step that Armstrong recommends is that the resultant plan should provide



for explicit feedback (or monitoring) at given intervals, something few organizations master for long term planning (Armstrong, 1982).

In his study of oil majors, Grant (2003) found that “the dangers of using medium-term forecasts as a foundation for business and corporate plans became painfully apparent during the 1980s, when the accuracy of macroeconomic and market forecasts declined precipitously” (p. 506). Holmberg and Robert (2003) suggested that back-casting, a method for planning in uncertain circumstances in which the future desired conditions are envisioned and steps are then defined to attain those conditions, can deal with the kind of complexity that is caused by conflicts between short term and long term futures. Grant noted a shift of planning from “strategy-as-resource-deployment” to “strategy-as-aspirations-and-performance-goals” that drove oil majors to more informal planning processes, thereby shortening planning horizons and placing more emphasis on strategic direction than specific planning. He found that much of strategy formulation eventually occurred outside of companies’ formal strategic planning systems. Grant concluded, “The strategic planning systems of the international majors could be described as a process of ‘planned emergence’” (p. 513).

In their study of collective impact through cross-sector collaboration, Kania and Kramer (2011) explored large scale social change in complex systems. They found five conditions that contributed to alignment and positive results: “a common agenda, shared measurement systems, mutually reinforcing activities, continuous communication, and backbone support organizations” (p. 39). While not expressly focused on strategic planning, their work attempted to investigate the role of diverse organizations in developing innovative solutions for social change. In studying several organizational efforts to tackle large scale social problems such as community obesity among children in Massachusetts, regional shortfalls in education in Cincinnati, and widespread impoverishment of cocoa farmers in Cote d’Ivoire, Kania and Kramer found five collaboration elements that contribute to successful endeavors: funder collaboratives; public-private partnerships; multi-stakeholder initiatives; social sector networks; and,

collective impact initiatives. It is clear that in such a cross-sectoral collaborative environment, strategic planners would need to consider how best to align these efforts within a strategy.

The need for innovation and creativity in guiding the development of new mental models to inform strategic thinking is a frequently cited purpose of strategic planning. Bryson suggests that “Usually key decision makers need a reasonably structured process to help them identify and resolve the most important issues their organizations face,” and that strategic planning requires “a series of discussions and decisions among key decision makers.” He believed that such discussions represent the innovation that strategic planning offers most organizations (Bryson, 1988, p. 74). Mintzberg (1994) reminds us that a strategy can be deliberate but that it can also be emergent, meaning that strategies can develop inadvertently through a process of learning. The problem, he explains, is that “a dense hierarchy can fail to capture this kind of strategic learning systematically” (p. 25). Mintzberg also recognized the need to affect the mental models of decision makers. He offers the following quote from Arie de Geus, former head of planning for Royal Dutch Shell, in describing “the real purpose of effective planning” as “not to make plans but to change the ... mental models that ... decision makers carry in their heads” (p. 26). System thinking and system dynamics modeling may play a key role in changing these mental models.

### **C. INDUSTRIAL CLUSTERS**

Historically, the concept of shared common property and resources, combined with aspects of business or agricultural development and social structures, can be seen as systems or networks of communities of interest. Today, many regional strategic planners have studied the development of industrial clusters as the means to aggregate economies for competitive advantage. In a somewhat controversial but widely cited article, dealing primarily with overpopulation, Hardin (1968) discussed a phenomenon he described as “the tragedy of the commons.” His notion was based on a short piece written in 1832 by a mathematician named William Forster Lloyd that described overgrazing in common-access land in medieval and post-medieval England. The premise of the “tragedy of the

commons,” as described by Hardin, was that herders could gain individual benefit by increasing their livestock when given access to commonly shared pastures, without regard for the collective overgrazing that would result when all herders with access acted similarly in their own self-interest. Cox (1985) challenged the historical accuracy of Hardin’s assertion, clarifying that the English commons of this time period were not available to the general public, rather, access was granted discriminately and the carrying capacity of the of land was protected through regulation by public laws.

Forty years later, in a *Harvard Business Review* article, entitled, “Restoring America’s Competitiveness,” Willie Shih and Gary Pisano (2008) described what they called *industrial commons*. Taking a more benign, though still perhaps historically flawed, perspective of the commons, Shih and Pisano wrote:

Centuries ago, ‘the commons’ referred to the land where animals belonging to people in the community would graze... Industries also have commons. A foundation for innovation and competitiveness, a commons can include R&D know-how, advanced process development and engineering skills, and manufacturing competencies related to a specific technology. (2008, pp. 116–117)

Pisano and Shih assert that as industrial commons take root, they promote a virtuous cycle that creates jobs and networks of knowledge to attract talent, businesses, suppliers and technology (p. 117). O’Boyle (1994, revised 2009) describes several “workplace regimes” associated with industrial commons covering both privately- and state-controlled industrial clusters. O’Boyle goes on to name eight characteristics of an industrial commons: joint use, limited access, optimal scale, workplace rules, collective internal control, external control of decision-making, cooperative spirit, and central purpose. But does the term, “industrial commons”—which connotes a degree of shared but controlled access—mean the same thing to the many people who use it? Michael Porter (2000) uses the term “clusters” to describe a critical mass of “geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate” (p. 16).

Gordon and McCann (2000) maintain that a broad definition of clustering conflates different ideas that have arisen from the fields of economics and sociology (specifically social network theory). They suggest that a further refinement of the definition should distinguish between three forms of clustering: the classic economics model of agglomeration” (focused on leveraging proximity for increased opportunities to offset market uncertainty); the “industrial complex model” (a “closed club” focused on cost savings in relation to production linkages); and, the “social network model” (developed by Granovetter focused on maximizing trust through personal and organizational linkages). Gordon and McCann (2000) conclude that the social network model is neither fully “open” nor fully “closed” and exhibits characteristics of both the other models cited. Porter concurs that there is a difference between his use of “clusters”—that leverage information and complementarities in the public / private sector to lower barriers to new business formation and to improve the environment for productivity—and traditional agglomeration, that is focused on cost minimization. Porter (1998) also recognized the role social networking plays in forming viable clusters. While there is clear overlap in the descriptions of commons and clusters, epistemological ambiguity arises.

As described by Porter and others, industrial clusters display the characteristics of complex and adaptive systems of systems, bringing resources together in a network of education, research and development, commercial interests, labor and manufacturing. Complex and adaptive systems consist of feedback mechanisms to facilitate adaptation and the creation of new solutions as time unfolds within an uncertain future (Glass, Brown, Ames, Linebarger, Beyeler, Maffitt, Brodsky, & Finley, 2011). Beinhocker (2006) suggests that today’s global market is perhaps better understood in terms of “complexity economics” than through the more mechanistic models derived from the mathematics, physics, and philosophies prevalent in the 1700 and 1800s. Beinhocker makes the case that as a human science, economics continues to adapt through complex algorithms of evolution. Each industrial cluster might then be thought of as having self-organized by leveraging strong and weak ties among innovators, academics, venture capitalists, labor groups, and manufacturers through an evolutionary process. In this

nexus of entrepreneurial interests might be revealed the self-organizing elements of what early economist Adam Smith described as the “invisible hand” in his classic, “Wealth of Nations” (Campbell & Skinner, 1976-83). By merging the concepts of network and system theory with the methodologies of system dynamics it may be possible to identify the structure (hubs of stock and the connectivity of flow) of successful networks of self-organization that constitute industrial clusters.

Bresnahan and Gambardella (2004) edited a compendium of accounts of successful high technology clusters—specifically in the field of internet and communications technologies (ICT)—compiled in collaboration with academics, scholars, economists, and practitioners affiliated with the Stanford Institute for Economic Policy Research. Included in this compendium of research were clusters in Ireland, Israel, Scandinavia, India, Taiwan, and the Silicon Valley of Santa Clara, California as well regional venture capital and science parks elsewhere in the United States. It was the authors’ stated intention to look beyond what they refer to as the “recipe approach” to cluster development (“Take one great university, sprinkle with liberal doses of venture capital, mix in an entrepreneurial culture’ and start the virtuous cycle”) to a deeper understanding of long-run economic growth (p. 2). Bresnahan and Gambardella defined a regional cluster as a geographically spatial and business-sectoral concentration of firms, and they measured success “by the ability of the cluster as a whole to grow, typically through the expansion of entrepreneurial startups” (p. 2). Their compendium of essays examined internal and external effects, competitive advantage, government policies, innovation, and information sharing among competitive companies. Furthermore, the roles and linkages of so-called old economy (“organizational and firm building activities, investment in general and industry-specific human capital, larger companies and related economies of scale at the level of the firms, and lengthy periods of investment...”) and new economy (“very rapid success for entrepreneurship, economies of scale at the level of regions or industries rather than firms, external effects”) firms were explored (p. 333).

Iammarino and McCann (2006) discussed the relationships between physical location, innovation processes, and industrial clusters and suggested that transactions costs among competitors could be used to classify cluster types and to better understand

how clusters evolve. They further offered a knowledge-based taxonomy for clusters. Like Bresnahan and Gambarella, they found that various technological regimes and industrial structures often seek simplified constructs that appeal to policy-makers seeking easy solutions to complex problems. The three cluster types they identified were largely consistent with previous studies already cited: pure agglomerations (to offset market uncertainty), industrial complex (to leverage economy of scale), and social network (building upon trust among personal and professional organizational connections). They found that while clusters may contain characteristics of each of these types, their unique proximity and transaction costs will evolve into one type being dominant. Iammarino and McCann saw three key factors influencing the geography of innovation: “a rich ‘soup’ of skills, ideas, technologies, and cultures...; a permissive environment enabling unconventional initiatives to be brought to the marketplace; and vigorously competitive arenas operating selection criteria which anticipate and shape those of wider future markets” (p. 1020).

In discussing the social network cluster, Iammarino and McCann (2006) distinguished between the “old social network type” that lacked a clear hierarchical structure and in which innovation was a mix of cooperation and competition, and the “new social network” that is more dependent on relational and cognitive proximity. This aligns with Bresnahan and Gambarella’s old and new economy construct (Bresnahan & Gambardella, 2004). Iammarino and McCann concluded that innovators will gather geographically and facilitate the emergence of clusters where conditions of opportunity and competitiveness co-exist. They further address the need to understand central issues that are specific to each individual cluster, including the structure, strategy and competition relationships that exist. One example is the oligopolistic structure that is characterized by a few large firms that divide major market share and are skeptical of sharing knowledge that could result in diminished competitive advantage.

In their study, Bresnahan and Gambardella (2004) concluded that “agglomeration economies alone cannot explain how or where regional clusters emerge” (p. 333). They found that characteristics of old and new economies were complementary in most regional information technology clusters case studies they examined, including Israel,

Ireland, Scandinavia, England, and Taiwan. The editors maintained that the various contributors to their study demonstrated that different economics are involved in starting and sustaining clusters. Starting a cluster involved building the foundations of industry and stimulating entrepreneurial interest. Among the factors that contributed to the success of regional clusters was sustained investment and developing the pre-conditions that allow innovation clusters to succeed. They found it took years of firm-building and market building to achieve success. Specifically, they noted that, “The long term investment in education of a skilled labor force has been critical in a number of regions...” And while there is no magic recipe, “a number of different routes exist to building the backdrop—technology opportunity, educated labor, flow of entrepreneurial talent, and so on” (pp. 336, 337). This is consistent with other observations of the clustering effect already cited (Gordon & McCann, 2003; O’Boyle, 1994, revised 2009; Porter, 2003), but underscores the need for a tailored approach to regional cluster development.

Jonas (2007) investigated structural complexity in the development of regional clusters in the context of emergence and self-organization. He cited the work of Keeble, Lawson, Moore, and Wilson (1999) who found that the development of a common language, knowledge of opportunities for cooperation, and consensus on problem solving strategies contribute to the emergence of shared knowledge. He further cited the work Luhmann (1997) had done in analyzing emergence within socially complex social systems. Jonas framed his research in the context of action and social practices. This work is consistent with system and social network theories discussed earlier. In research literature that examines the mechanisms of industrial clusters, the terminology of system dynamics (specifically feedback loops) is frequently cited along with the concepts of emergence, self-organization and information flow (Feldman, Francis, & Bercovitz, 2005; Gordon & McCann, 2000; Humphrey & Schmitz 2002; Kenny & von Burg, 1999). In his analysis of Senge’s tragedy of the commons archetype, Bodhanya (2009) applies concepts (feedback loops, stock, flow) and tools of system dynamics to model a sugar cane supply chain. Using similar methodology, my research was intended to evaluate the structures and behaviors that comprise an industrial, or regional, cluster.

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### **III. METHODOLOGY**

This chapter discusses the qualitative, action research approach to grounded theory methodology employed in this study, as well as the coding mechanisms used to derive emergent themes for analysis and theory-building.

#### **A. ACTION RESEARCH CASE STUDY**

In order to answer my research question, “How does system thinking and the use of system dynamics modeling inform regional strategic planning?” I chose to take an action research approach to case study analysis of the Steinbeck Innovation Cluster Foundation’s creation and strategic planning effort in order to evaluate the impact of system dynamics modeling on the participants. In so doing, I applied the core concepts of grounded theory—constant comparison and theoretical sampling. The value in this approach was the development of an emergent theory through both analysis of data gathered and sensitization derived from my own immersion in, and interpretation of, the data. My objective, therefore, was not to verify theory previously espoused by related literature, but to allow categories and concepts to emerge from the subjects themselves.

In contrasting grounded theory with logico-deductive theory, Glaser and Strauss (1967) extoll the benefits of theory that is inductively developed. Their strategy of comparative analysis for generating theory places the emphasis on theory as a *process* and they maintained that, “Qualitative research is often the most ‘adequate’ and ‘efficient’ way to obtain the type of information required to contend with the difficulties of an empirical situation” (p. 18). Suddaby explained that Glaser and Strauss provided a process that allows the emergence of theory that represents a compromise between empiricism and relativism through the systematic collection of data that incorporates the interpretive realities of social research. But Suddaby also pointed out that, “Glaser (1978) used the term ‘theoretical sensitivity’ to describe the essential tension between the mechanical application of technique and the importance of interpretive insight,” concluding that grounded theory is not simply a formulaic methodology (Suddaby, 2006, p. 638). Dooley explained that when applied to theory building, case study research is a

method that can help us understand complex issues while contributing to previous research. He added that, "...case study research approaches the purpose and methodology of grounded study research—the conceptual development and operationalization of a new theory" (Dooley, 2002, p. 350). By applying a grounded approach driven by theoretical sampling, I was better able to allow theory to emerge from the case study data collected.

Bradbury and Reason (2003) describe action research as being grounded in the experiences of the researcher who is working in partnership with the subjects of a study to address problems of significance to the community. In the process, the researcher and the people with whom he or she works develop new ways of seeing the world that can then be captured in a theory. Bradbury and Reason explain that multiple qualitative research methods may be employed and that distinctions between researchers and subjects may become blurred as a result of the collaborative relationships established between them. The authors assert that although action research may take the form of first, second, or third person practice, "All have in common a commitment on the part of a group of organizational practitioners from diverse organizations, field-consultants/organizers and researchers to work together and share insights across the entire community and beyond" (p. 167). Action research was particularly relevant in my Case Study of a regional cluster strategic planning process and was well aligned to what Whittington referred to as "strategy-in-practice," discussed earlier (Whittington, 1996).

My role in the Steinbeck Innovation Project was described by one of the subjects interviewed as being that of a "thought leader." As part of the strategic planning team, I provided an overarching systemic vision for a sustainable strategy of economic growth in the region. I participated in every phase of planning, from long term vision to the assembly of key civic, academic, and private-sector stakeholders. I was able to attend all significant meetings and discussions and to introduce concepts of system thinking and system dynamics methodology. I exchanged over 3,500 e-mails and correspondence, had access to formal meeting minutes, and was consulted in the development of diagrams, presentations, memoranda of agreement, and planning documents that would eventually

constitute a formal regional strategic plan for sustainable economic development that came to be known as the Steinbeck Innovation Cluster (see Chronological Narrative Appendix A).

During this process, I developed causal loop diagrams that applied Senge's tragedy of the commons archetype to shared water resources in the region (Senge, 2006), and used these to argue that sustainable economic development could not be gained by simply adding additional acreage for agriculture, the region's core economy, without running the risk of overshooting the region's limited water capacity. Rather, I maintained that by leveraging the city's proximity to the Silicon Valley and several local research institutions, it might be possible to develop an industrial cluster focused on the manufacture of advanced agriculture technologies. Ghaffarzadegan, Lyneis, and Richardson (2011) propose the use of small system dynamics models (containing a limited number of stocks) to inform public policy decision making. Consistent with this approach, and to demonstrate the systemic nature of strategic planning, I worked with local-area experts to develop five system dynamics modules integrated into a single system of systems model that could be used to provide an enhanced appreciation of non-linear behavioral outcomes of the policy decisions that would be required to implement the strategy. The Steinbeck Innovation Cluster strategy was developed between April and December 2012 and was publicly announced by the Mayor of Salinas in December, 2012.

What is apparent from the convergence of the three bodies of research cited in the literature review is that strategic planning in the business and civic community pays little explicit attention to social network and system aspects of industrial/regional clustering that would allow them to be successfully modeled. Specifically, when social networking (clustering, hubs and linkages) or elements of system theory (feedback loops) are cited, there is little reference to the modeling methodologies of system dynamics or the core concepts, cited earlier, that system dynamics is intended to address: dynamic complexity, policy resistance, and structure/behavior relationships.

## **B. RESEARCH PROCESS**

The unique role I played as an active participant in the Steinbeck Innovation Cluster strategic planning process allowed my observations of group dynamics, individual personalities, and networks within the community to evolve over time. The insights I gained during the course of the case study drove my own emergent understanding of the process as well as the objectives we were formulating in the strategy. My role, which was understood from the beginning, as providing a higher level, strategic perspective, allowed me to introduce systems thinking and a longer time horizon than perhaps would otherwise have been considered. Throughout the process, I was frequently called upon to write articles, address diverse fora of community members, and to interact with a broad spectrum of community and civic leaders, educators, university representatives, and business professionals, including corporate executives from the agriculture industry. I was often asked to present the “vision” and concepts of the Cluster in a strategic construct, bringing together aspects of the cluster and systems research I had been conducting with my own military experience in strategic planning. This regular interaction with key stakeholders within the community and across the region allowed me to develop a relatively deep understanding of the dynamics at play within the systems I came to understand as drivers of the overall strategy: education, water, gang influence, investment, and the components of area attractiveness.

My research process emerged over time from my role as an active participant in the Steinbeck Innovation Project and consisted of the following sequence of steps:

1. Evaluate observations and relevant data collected as a participant in the Steinbeck Innovation Project to develop emergent themes related to the case study’s strategic planning process.
2. Develop a system dynamics model using five integrated modules that reflects key systems/problems addressed by the strategy, and using subject matter experts to validate the model structures, data inputs, and behavioral outcomes.
3. Run the model for participants and key stakeholders to assess their perception of the value added and insights gained from interacting with these models; and,

4. Code and analyze pre- and post-intervention interviews and questionnaires to qualitatively develop a grounded theory of the enhanced understanding to be gained through the use of system dynamics modeling in the strategic planning process.

The approach I have taken in this action research study is to qualitatively evaluate the impact system dynamics models had, after the fact, on previously held mental models used by the study's participants to develop the strategy.

### **C. MEASURING THE IMPACT OF SYSTEM MODELS**

I have chosen to take a similar, though less quantitative, approach as that espoused by McCormack and Ford (1998) in research they conducted to evaluate the impact of management flight simulators—a system dynamics modeling tool—on policy development. In my study, I conducted pre-intervention interviews and had each participant respond to a simple questionnaire that addressed their understanding of key elements of the Steinbeck Innovation Cluster Strategy and feedback mechanisms within the systems of that strategy. I then introduced the models and re-administered the questionnaire, followed by a post-intervention interview.

My aim was to better inform my qualitative analysis by evaluating the non-statistically significant, but nonetheless informative, questionnaire results in order to obtain a better understanding of how each participant's mental models had been affected by the intervention. This data was then integrated with the results of my coding and analysis of pre- and post- intervention interviews to broaden the depth of my findings and to contribute to the development of a grounded theory on the impact of system dynamics modeling in the strategic planning process.

### **D. CODING METHODOLOGY**

As is probably typical of many strategic planning efforts—and was certainly the case for those in which I have participated—the team directly involved in the Steinbeck Regional Innovation Cluster strategic planning process was intentionally limited. In fact, the “Executive Committee,” as it came to be known, only included 10 members, myself included, over an eight-month period. While a sample size of nine participants is too small to draw any statistical conclusions from analysis of the interviews I conducted

(both before and after exposure to the final system dynamics models), it is sufficient for the generation of grounded theory based upon theoretical sampling and the saturation of categories that emerged (Glaser & Strauss, 1967). I limited my interviews to those with direct, participatory knowledge of the planning process. My sense, from having been embedded in that process, is that interviews with “outsiders” would be of limited use, since they would only be able to speculate about the actual process that evolved from April 2012 through December 2012 and that culminated with the public roll-out of the Steinbeck Cluster strategy and Steinbeck Regional Innovation Foundation. Glaser and Strauss stress that “The researcher who generates theory need not combine random sampling with theoretical sampling when setting forth relationships among categories and properties” (p. 63).

I conducted two sets of semi-structured interviews with the nine other Executive Committee participants: a “pre-intervention” set, and a “post-intervention” set. In the first round of interviews, a list of interview questions was used to stimulate anecdotal responses. The questions themselves were carefully constructed to avoid “leading” any terminology in participant responses (e.g., the terms “network” and “systems” were never used explicitly in questioning the subjects). After interviewing the nine participants and transcribing the audio tapes, NVivo software was used to conduct first level, in vivo coding of each transcript.

Following the first round of interviews, this coding process resulted in the compilation of 226 coding nodes (key words or ideas) that emerged from the subjects’ responses to the semi-structured interview questions. Using the method of second level axial coding, the 226 sub-nodes were then sorted under 22 families of nodes. This set of node families captured key categories and properties that had emerged from first level, in vivo, coding. Each transcript was then carefully reviewed again and annotated to derive themes that would be addressed in the findings of my dissertation. These themes represented a third level of coding based on concepts that had emerged thus far. The second, post-intervention, round of interviews, was more structured than the first, with each participant asked to address specific take-aways from the model they had just seen demonstrated. The coding of these interviews resulted in 27 nodes that were then

consolidated under three node families: modules, insights, and, utility. The responses to post-intervention questions were then analyzed in the context of the themes that had emerged from the third level coding already cited.

While reviewing in vivo terminology used by each respondent, it became clear that among the nine participants, three distinctive perspectives were revealed in the composition of the strategic planning team: the private sector; the non-profit sector; and, the civic sector. This observation was consistent with the three organizational sub-types—profit, non-profit, and governmental—proposed by Rouwette, Vennix, and van Mullekom (2002). The nine subjects were evenly distributed among these three sub-groups, with three members representing entrepreneurial interests of Silicon Valley, the agriculture industry, and new business start-ups; three subjects representing the interests of community education and social benefit; and, three subjects representing the interests of the city, which merged the interests of both the private and the non-profit sectors. This insight provided the means to compare and contrast common terminology and concepts that were employed differently within each grouping, characterized by nuances of motivation and prioritization unique to members of each group. Overarching themes that emerged from the coding were then evaluated in terms of the different perspectives that each group brought into the strategic planning process. This coding process was then applied in analyzing the second round of interviews with the same participants.

Before familiarizing each of the nine participants with the model, I administered a short pre-intervention questionnaire to get an idea of their own mental model of the strategy. I then explained the model and the control panel/flight simulator before giving them the opportunity to change inputs in the control panel and run the system dynamics model. Following the model runs, I re-administered the questionnaire and conducted follow-up, post-intervention interviews.

An example of the hierarchy of sub-nodes, families of nodes, and resulting themes is illustrated in the following example. Ten nodes emerged through first level coding that related to the role of government in the planning process. These nodes included: Government, CASP (Community Alliance for Safety and Peace), city managers, infrastructure, mayor, politics, public safety, public sector, regulations, and the city. Since

all of these nodes represented some aspect of government, they were then grouped under a family of nodes by that name (representing 97 references among the sub-nodes across the first round of interviews). One of the themes that emerged from the coding process is that, “There are inherent limitations when collaborative strategic planning is undertaken by a diverse, cross sectional team.” One aspect of leadership that emerged from the “government” family of nodes was the vital role that city managers can play in prioritizing civic objectives in the strategy. Several subjects noted that the mayor, elected officials (in the civic sector), and members of the private sector and the non-profit sector were all unable to provide this unifying leadership due to perceived political motives and lack of direct control over city resources.

Of the 27 nodes identified through first level, in vivo coding of the post-intervention interviews, three node families emerged from second level, axial coding. These node families—insights, sub-systems, and model applications—represented the three areas of impact most cited by the participants. These three node families, or Areas of Impact, were then used to analyze how participant perceptions had changed with regard to the themes that emerged from the coding of the first, pre-intervention, interviews. The theory that evolved during this process was that a system dynamics decision tool could provide an enhanced understanding of the feedback mechanisms and interdependencies of complex systems and would better inform decision makers to avoid policy resistance in strategic planning and implementation.

Taken together, the pre- and post-intervention interview first level coding resulted in 282 sub-nodes, which were then collected through second level coding under 25 node families. Three participant groups and four themes emerged from third level coding of the pre-intervention interview data (see Figure 1), and those groups and themes will be further explored in Chapter V.



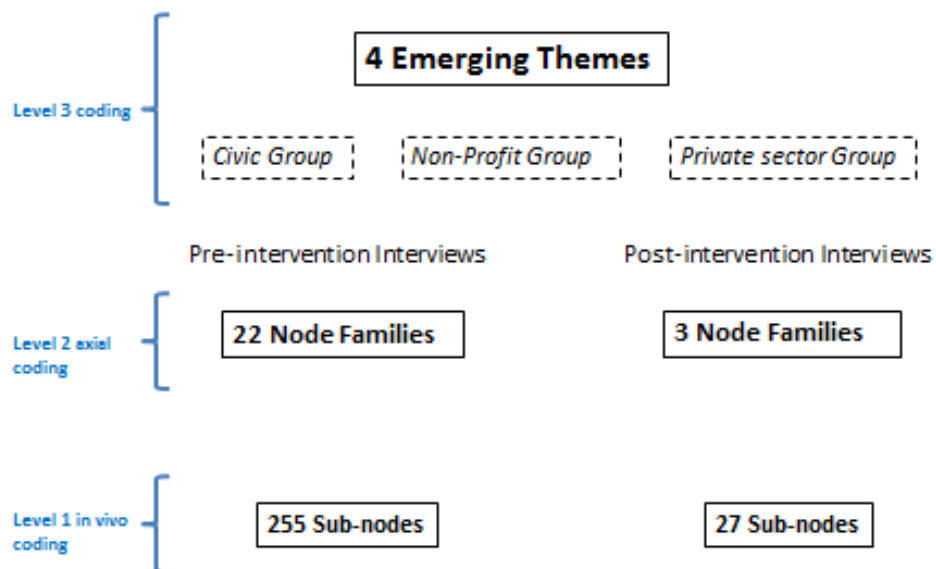


Figure 1. Pre-intervention Coding Hierarchy

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## **IV. USE OF MODELING**

This chapter explains the purpose of using system dynamics modeling in support of strategic planning and describes the iterative process of developing system modules for integration into a system dynamics model of the Steinbeck Innovation Cluster strategy. Further, the method of validation is explained and an overview of each module is provided along with a short description of the modeling outcomes.

### **A. THE NEED FOR MODELING**

As was discussed in my Literature Review, the emergent nature of complex systems implies that today, explanation and causation have taken on new meaning and the aim of design and predictability seem much less assured. A good theory for strategic planning, then, involves a process that delivers a greater understanding (or series of proposed scientific explanations) of our complex environment but whose goal may simply be to provide a spectrum of desired outcomes rather than a single, designed course of action. The qualitative value of system dynamics models would seem to lie in their ability to provide decision makers a better awareness of possible outcomes based on an accepted portrayal of system structures. System dynamics models may offer policy makers and investors a tool that provides the means to better understand dynamic complexity, structure/behavior relationships, and to partially offset the effects of policy resistance in the strategic planning process and in the implementation of the resulting strategy.

### **B. INITIAL CAUSAL LOOP MODELING**

As part of my early research and work with the Steinbeck Cluster executive committee, I prepared preliminary causal loop diagrams (CLDs) to portray for stakeholders the competing interests of farmers and ranchers in regional water management as an example of the tragedy of the commons archetype (Figure 2) developed by Senge (2006). Of note, I could as effectively have chosen to model the archetype as a competition between berry farmers and lettuce growers, or between, raddichio growers and grape growers, or between farmers in the Salinas Valley and

residents of the Monterey Peninsula. Monterey County receives no water from “outside” sources with more than 90 percent of the water made available for use being drawn from replenishable aquifers within the county. These aquifers are dependent on rainfall for replenishment, and Monterey County frequently suffers drought.

Agriculture production is by far the largest industry in the Salinas Valley and competition for scarce water resources is fierce. What became clear from my early modeling and research was that the agriculture industry in Monterey County was already operating near the carrying capacity of the water system, so that attempting to develop a strategy of economic development dependent on adding agricultural acreage to increase production was not sustainable. Having studied the work of Harvard economist Michael Porter and others, it occurred to me that by leveraging education, the youth population demographics, local research universities, and the innovation, technology and venture capital of nearby Silicon Valley, Salinas might focus its effort on manufacturing the very components of “precision agriculture” (robotics, sensors, IT infrastructure, field packaging and product tracking) for export, while simultaneously improving local production and transitioning unskilled laborers to higher paying, more skilled jobs.

### SALINAS – Tragedy of the Commons (Overshoot)

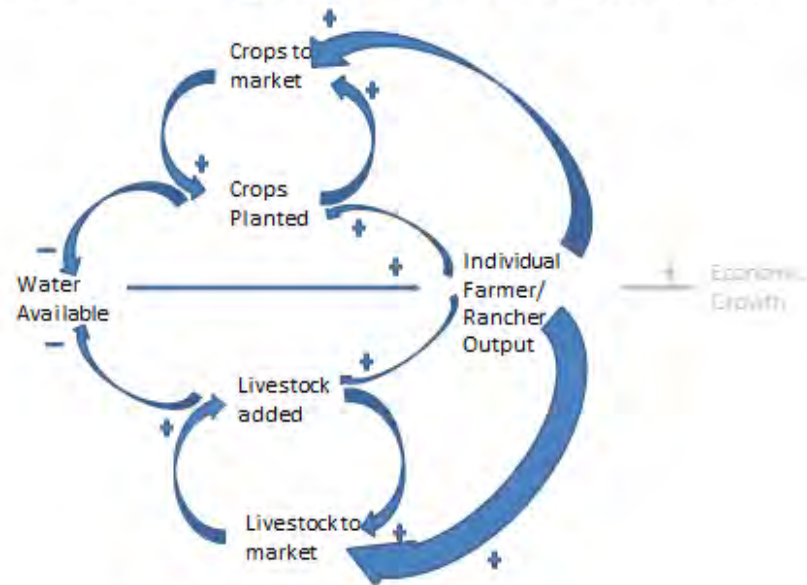
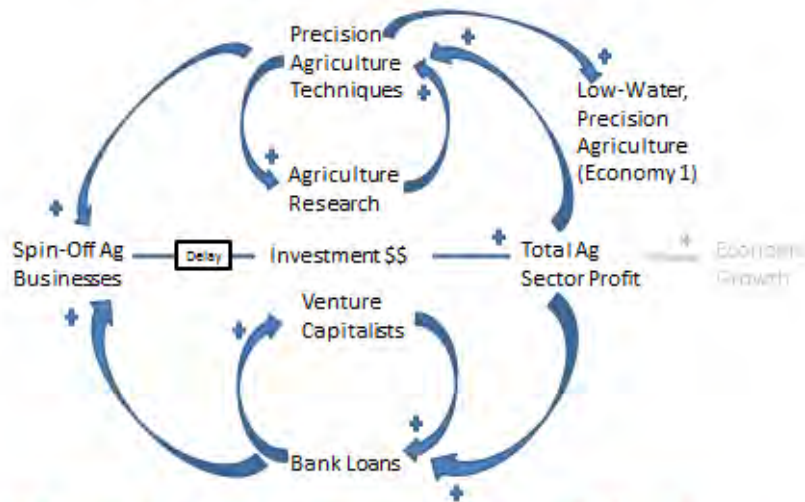


Figure 2. As Water Availability Decreases, Each Stakeholder is Encouraged to Maximize Their Own Share of Production before It's Too Late.

I used the CLDs to show how the application of research and technology could introduce negative feedback in this system to balance loop dominance, and, stimulate new business growth without overshooting the water resource carrying capacity of the region (Figures 3, 4).

### SALINAS VALLEY – Economy 2



As illustrated in the causal loop diagram I have constructed for "Economy 2" (defined as the infrastructure and mechanisms that create new business development in an existing economy), the path to economic growth need not depend on more farms and ranches and hence, more water usage.

Figure 3. Offsetting water shortage with Economy 2

### SALINAS – Tragedy of the Commons (S-Shaped Growth)

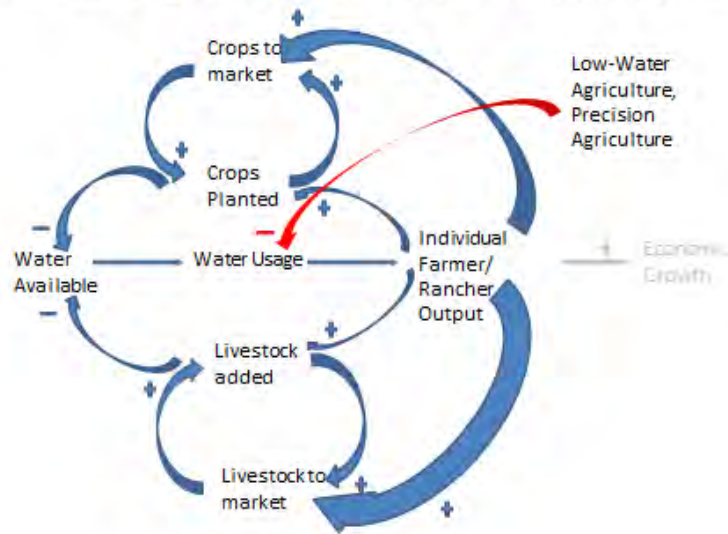
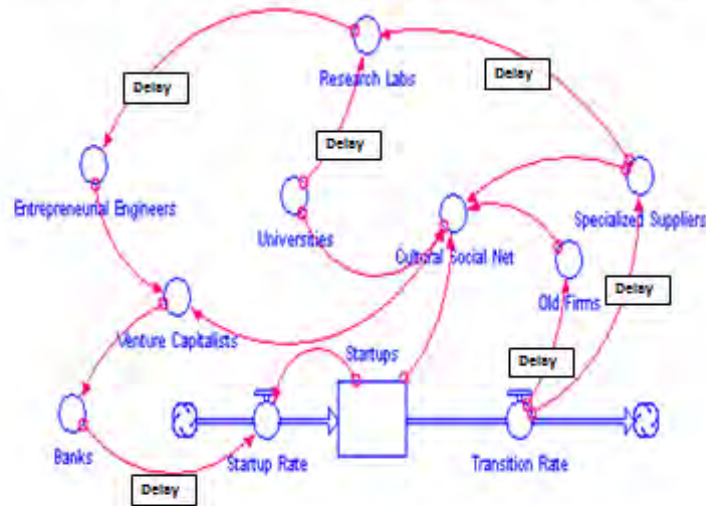


Figure 4. Balancing Water Tragedy of Commons

Finally, based on literature that described the growth of new start-ups in Silicon Valley (Kenney & von Burg, 1999), I developed a mock stock and flow diagram of new business development, incorporating key hubs and nodes of the business development network in a regional cluster (Figure 5).

### Economy 2 Mock up Stock and Flow Diagram



Based on Study of New Start-ups in Silicon Valley

Figure 5. Networks in Economy

These causal loop diagrams were shared with the Steinbeck Foundation Board members to inform the development of a regional strategy focusing effort on agricultural research and the development of high technology “precision agriculture” (low water level farming; environmentally sound desalination to increase water supply; remote sensors for real-time monitoring of soil and water chemistry, crop diseases, growth patterns; robotics for field processing and shipping; off-grid energy to minimize expense; waste and nutrient management to decrease cost and encourage more sustainable business practices; big data collection and analysis for market trends). It was anticipated that spin-off businesses related to the manufacturing of precision agriculture technologies could be created through venture capital investment—while at the same time providing the

technology and techniques to more efficiently produce crops and livestock using less water and resulting in less field wastage.

The objective was to create S-shaped growth/equilibrium at a higher state of economic well-being for the city and the region that built upon the region's competitive advantages of agriculture and IT technologies (Bresnahan & Gambardella, 2004). It was important, therefore, to identify the key sub-clusters and academic/professional hub(s) that will accelerate this growth. Fundamental to this strategy was the inclusion of targeted education and vocational training programs for area youth, water management policies intended to increase water availability, programs to diminish gang membership, and research to provide commercial technologies for entrepreneurial business opportunities.

### **C. MODELING CONSTRUCTS AND ARCHITECTURE**

In the paper, *How Small System Dynamics Models Can Help the Public Policy Process*, Ghaffarzadegan, Lyneis, and Richardson (2011) propose the use of small models (containing a limited number of stocks) to inform public policy decision making and to overcome policy resistance. Sterman explains that, "One cause of policy resistance is our tendency to interpret experience as a series of events...The event-oriented worldview leads to an event-oriented approach to problem solving" and "Policy resistance arises because we often do not understand the full range of feedbacks operating in the system" (Sterman, 2000, p. 10).

Over time, as the Steinbeck Innovation Cluster strategy took shape, it was clear that system dynamics modeling might assist city, county, and investment decision makers in understanding the systemic nature of a strategy for sustainable growth. Components of this strategy included education (agriculture technology curricula in high school, higher education, and vocational education), mitigating gang activity, improving area attractiveness for middle to high income earners and businesses, an integration of funding for operations, new business start-ups and research, and a model of water supply and demand. Consistent with this approach, with the help of area experts, I was able to develop five modules using iThink modeling software: Education for AgTech Employment; Gang Membership and Programs; Water Management; Investment, Funds,



Start-ups, and Research; and, Area Attractiveness/ Middle to High Income Earners. Each module was modeled independently, and then run as an integrated system model. These modules were eventually run for the Salinas Chief of Police, the Salinas Deputy Economic Development Director, the Assistant Manager of the Monterey County Water Resources Management Agency, and the Salinas High School District Superintendent and his staff for parameter, structure, and data validation. I integrated these five system dynamics modules in a system of systems model that captures the elements of the Steinbeck Cluster regional strategy (Figure 6).

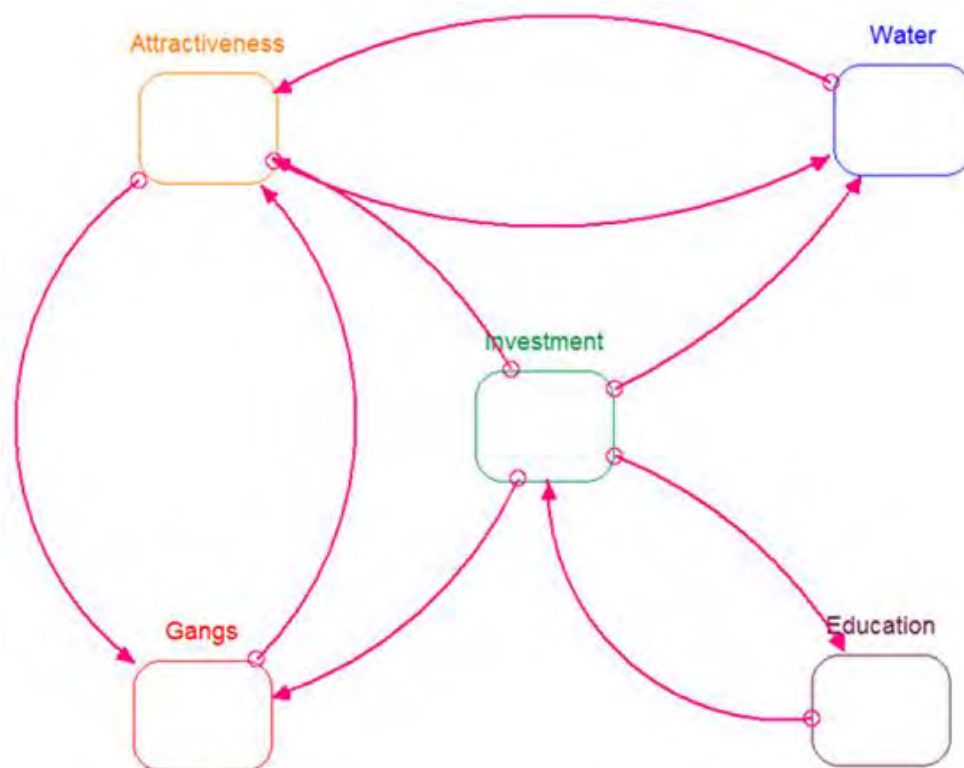


Figure 6. Cluster Model Architecture

This system of systems model also featured a control panel or decision flight simulator (Figure 7) that allowed decision makers to manipulate those inputs they could reasonably control: percentage of Steinbeck funds going to an investment fund for new start-ups; the percentage of funds going to research and education programs; the percent of total anticipated investments actually received; the percentage of Salinas public high

school students with access to agriculture technology curricula; the volume of water gained from desalination; and, the volume of water captured from reclamation.

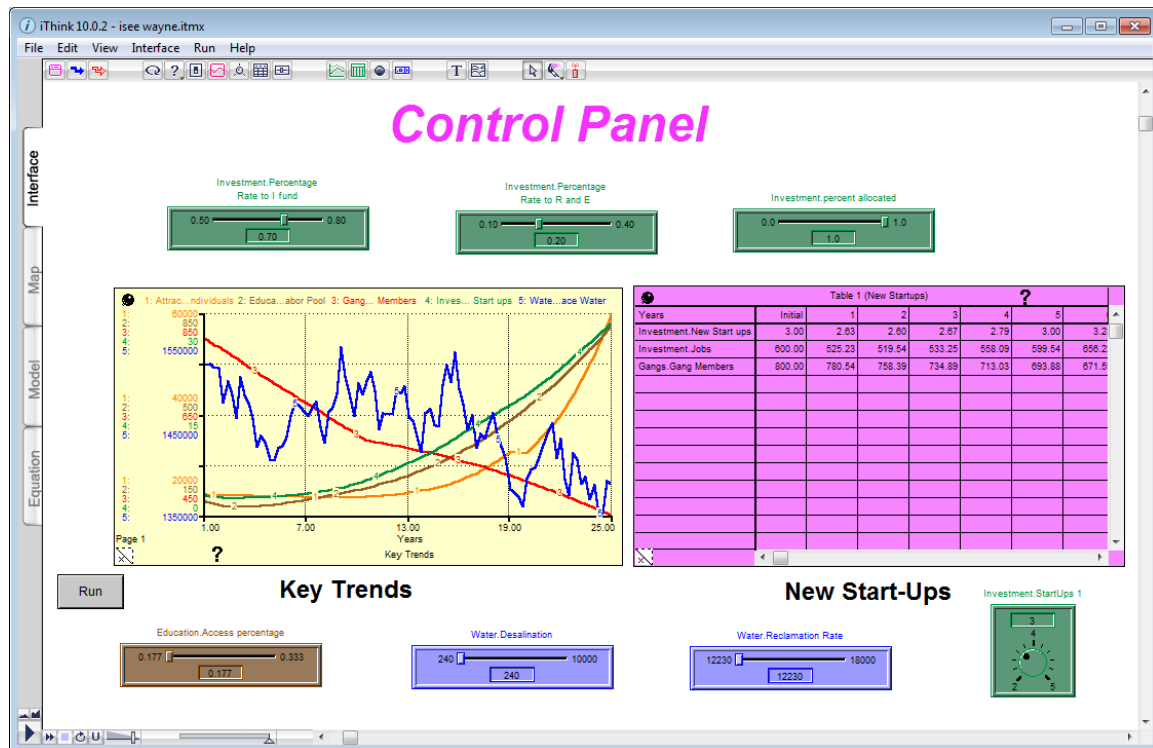


Figure 7. Control Panel/Flight Simulator

The purpose of the regional strategy model and control panel was to enhance the understanding of those who had participated in the strategic planning process as the means to qualitatively analyze the extent to which system dynamics modeling could inform regional strategic planning.

#### D. MODEL VALIDATION

My research focused on the use of system dynamics to model a proposed strategy vice the more traditional approach of using system dynamics to model existing system structures. In this case, I was attempting to model structures that were not yet in place, so the ability to validate the model structure and behavior by comparing the model's ability to replicate historic trends was not practical. Instead, I had key subject matter experts within the city of Salinas validate the model structures and the data used to populate the

models to ensure they reasonably reflected behavior from existing structures affected by the projected strategy. The Chief of Police validated the Gang Membership, Violent Crime Module. The Superintendent of the High School District validated the Agriculture Technology Education Module. The hydrologists in the Monterey Water Resources Agency validated the Water Module. The City Manager's office validated the Attraction Module. The former mayor and president of the Steinbeck Innovation Cluster Foundation validated the Investment Module. It should be noted that for purposes of qualitative analysis, the specific numeric outcomes of the models were seen as secondary to their value in providing stakeholders with an enhanced understanding of the feedback mechanisms, non-linear behavioral trends, and systemic interrelationships within the Steinbeck Cluster strategy.

## **E. SYSTEM DYNAMICS MODULES**

Each of the five system modules that comprise the system dynamics model are described briefly below. More detailed descriptions of the modules and data used to populate them are provided in Appendix B.

### **1. Investment for Education, Research, and New Business Start-ups/Jobs**

Because this was a purely conjectural module based on projections of investment made as part of the Steinbeck Cluster Strategy, there was no historical data upon which to base many of the equations. Assumptions were made based on research that had been done during the strategic planning process and through the first year of the Steinbeck Foundation's implementation. This module (Figure 8) features six stocks: Steinbeck Funds, Research and Education Fund, Investment Fund, Start-ups, Bought Out, and, Failed Businesses. See Appendix B for details and equations for each module.

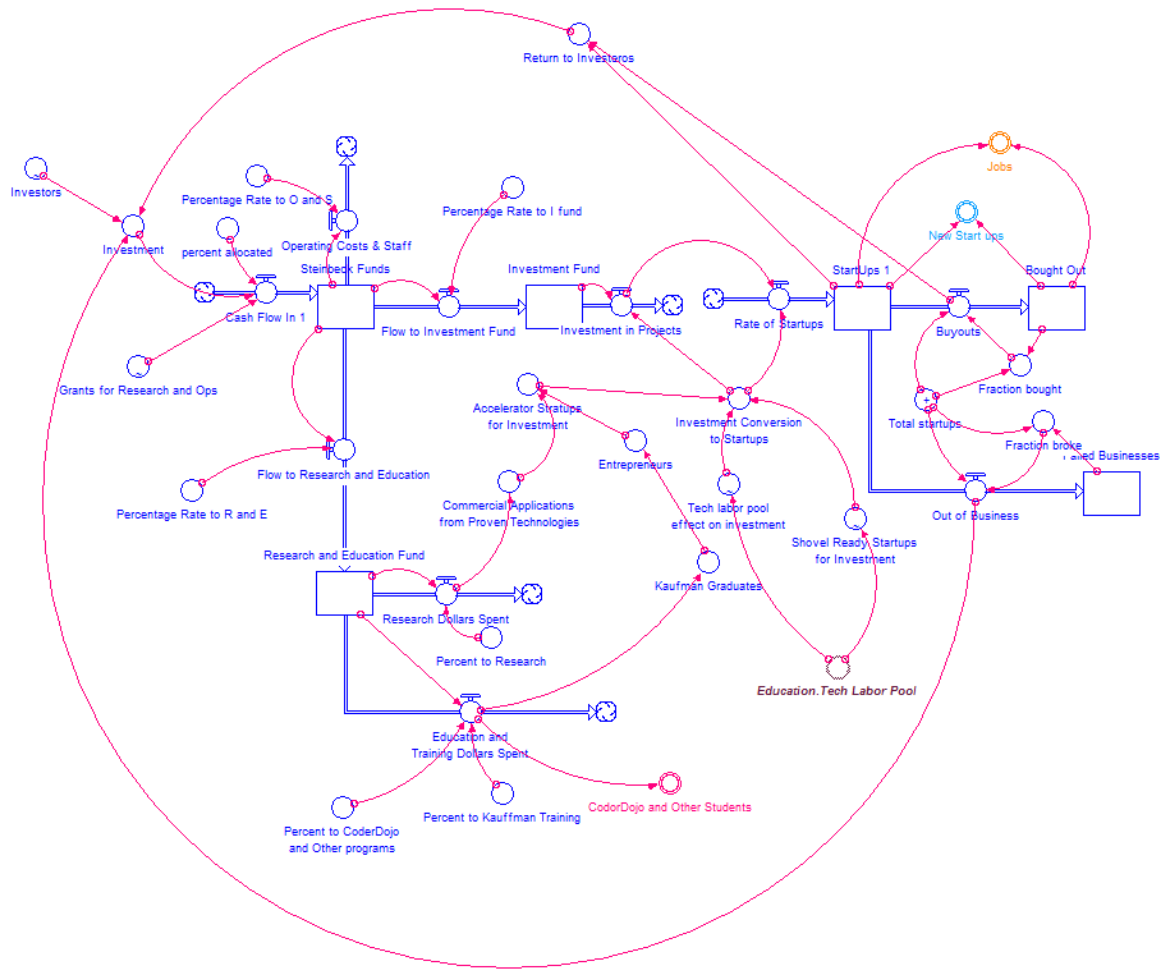


Figure 8. Investment for Research, Education, Start-Ups/Jobs

## 2. Ag-Tech Education

This module (Figure 9) illustrates the flow and feedback mechanisms among five stocks: High School (total students enrolled), General Higher Education (total students enrolled), agriculture technology (Ag Tech) and vocational education (VoEd) Higher Education (total students enrolled), Unemployed or Low Income (students leaving school without completing GED or pursuing higher education), and, Ag Tech Labor Pool (graduates of ag tech higher education). To estimate the number of high school graduates who go on to Ag Tech Higher Education per year, the equation was  $(\text{Access\_to\_Ag\_Tech\_Programs} \times 0.17) \times (\text{percentage of graduating seniors going on to higher Ag Tech education as a function of Hiring Rate})$ . Hiring Rate was a function of the

Hiring Percentage Over Time (estimated to be 85 percent) and the number of Ag Tech Jobs Available (a function of Jobs input from another module). As the Hiring Rate increases from 40/yr to 250/yr, the percentage of graduating seniors interested specifically in ag tech higher education was modeled to increase from 26 percent to 50 percent. Initially, the flow to Ag Tech and VoEd was computed as  $(1628 \times 0.17) \times 0.26 = 277 \times 0.26 = 72$ . (Actual estimate for current year high school graduates who went on to attend Hartnell, Fresno State, Cal Poly, and UC Davis was 73).

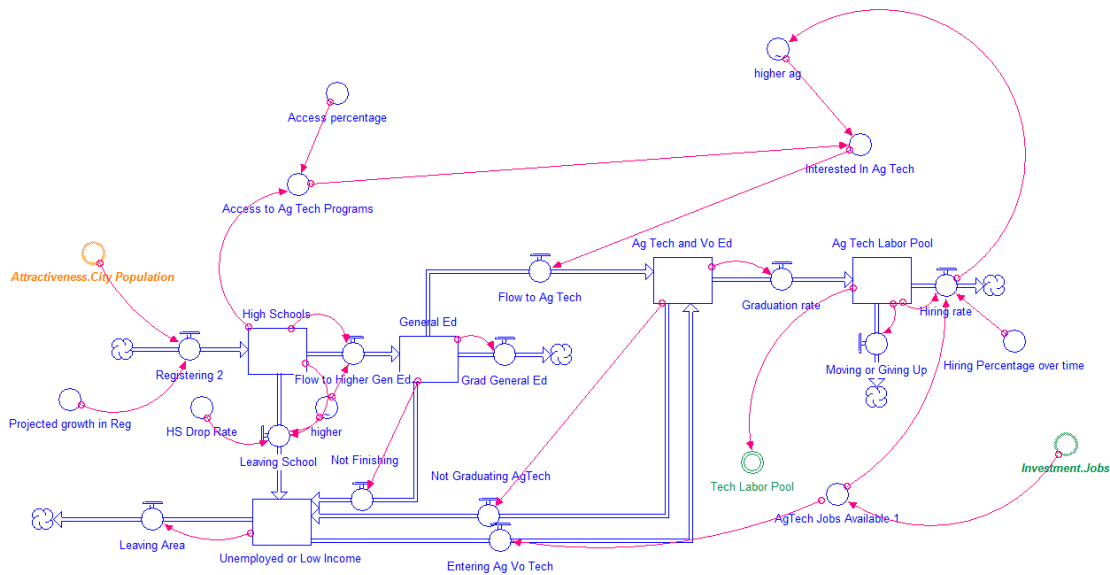


Figure 9. Education for Ag-Tech Employment

### 3. Gang Membership

The Gang Membership Module (Figure 10) is based upon a susceptibility/infectivity (S/I), disease diffusion logistics model. The pool of susceptibles, labeled Fifteen to Twenty Four Yr Olds (those susceptible to becoming infected with gang membership), is comprised of the Salinas population of individuals aged 15-24 years. The pool of infected Gang Members consists of criminally active gang members aged 15 to 35 years. The rate of flow from the Fifteen to Twenty Four Yr Olds pool to the Gang Member pool is a mathematic function of the Contact Rate (percent of Fifteen to Twenty Four Yr Olds in regular contact with Gang Members), Infectivity (the probability

of becoming a Gang Member as a result of regular contact), the size of the Fifteen to Twenty Four Yr Olds (susceptible) pool and the size of the Gang Members (infected) pool. Infectivity is diminished by Jobs growth (input from another module) via the Impact on Infectivity connector.

For purposes of modeling the strategy and based upon conversation with local STEM interns from gang-influenced families in East Salinas, it was estimated that 8–13 year old kids exposed to Coder Dojo or other STEM programs would be STEM Inoculated against Gang Membership upon reaching the age of 15 (and would be subtracted from the Fifteen to Twenty Four Yr Olds—susceptible-pool).

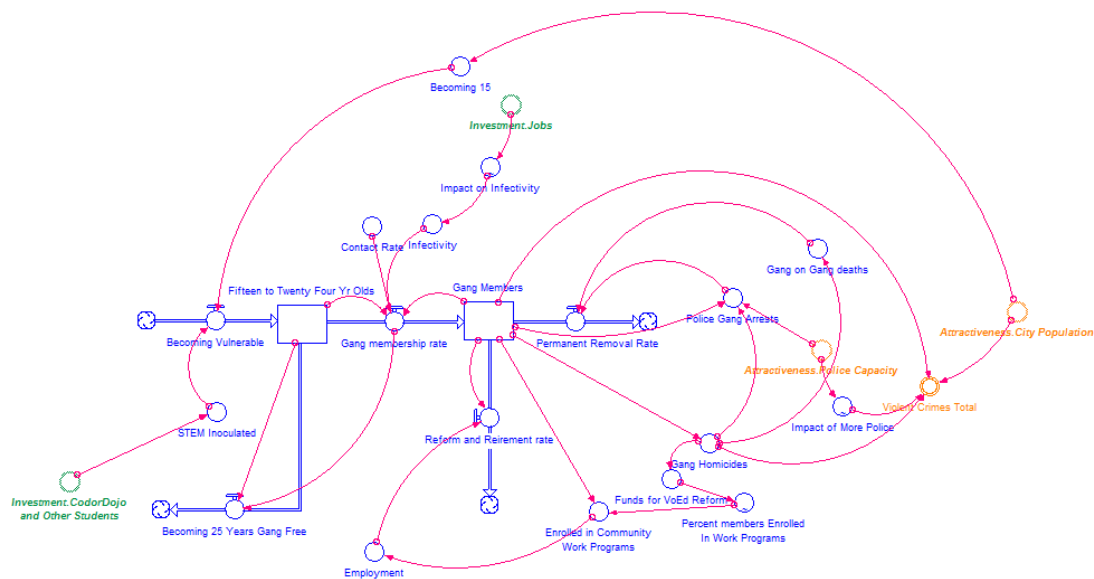


Figure 10. Gang Membership and Programs

#### 4. Water Management

All Monterey county water is supplied from within the county, largely through groundwater aquifers and some surface water capture. The aquifers and dams are replenished through annual rainfall. The Water Management Module (Figure 11) features two stocks only: Groundwater and Surface Water; and, Water to be Recycled. There are three primary demands placed on the water supply: Agriculture (90 percent of all demand); Residential; and, Commercial. Agriculture Demand is affected by the demands

from Commercial and Residential use and is augmented by Reclamation water. Agriculture Demand was calculated to be  $\text{Reclamation} + (\text{Water\_Available\_for\_Use} * (1.00 - (\text{Residential\_} \% + \text{Comm\_}\%)))$ . Residential Demand was initialized at 7 percent and Commercial Demand was initialized at 3 percent. Residential Demand/Usage was modeled to increase as a function of increasing High Income in-migrants (input from another module), and Commercial Demand/Usage was modeled to increase as a function of New Business Start-ups (input from another module), thereby somewhat diminishing Agriculture Demand/Usage over the run of the model.

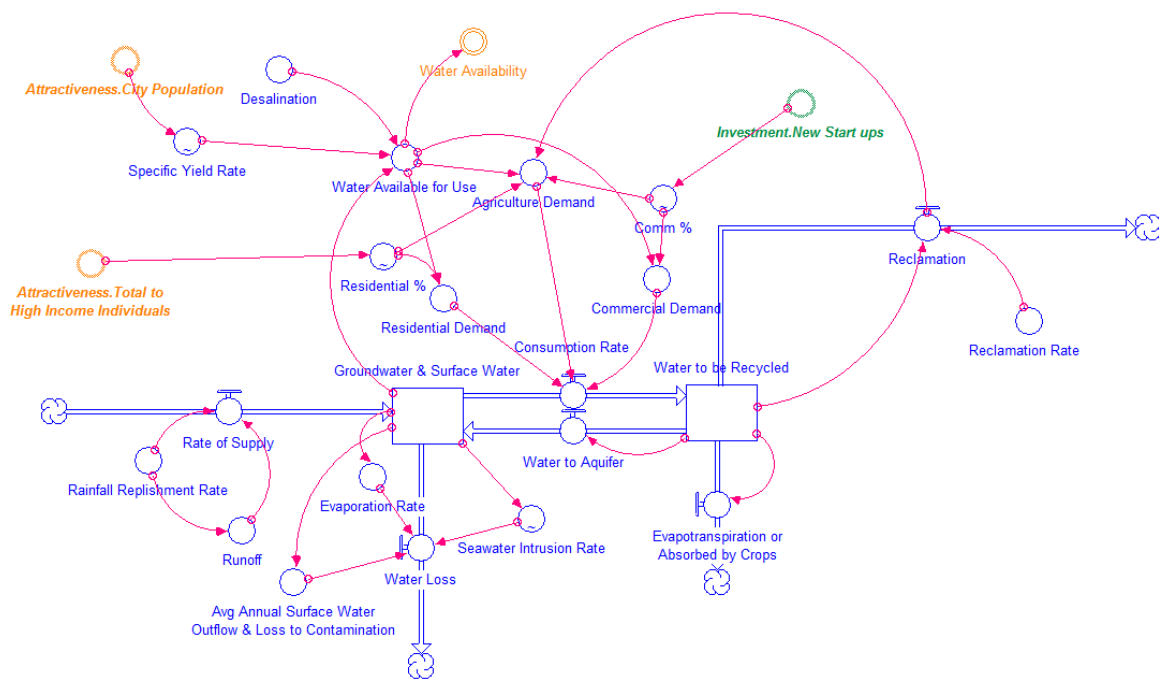


Figure 11. Water Management

## 5. In-Flow of High Income Earners, Area Attractiveness

The Area Attractiveness Module (Figure 12) is intended to measure the in-flow of Middle to High Income Earners (\$75K / yr) into Salinas from a pool of potential in-migrants from five nearby cities. Since the focus of this model is on attracting high-tech agriculture industry engineers and designers, the five cities chosen were San Jose, Santa Clara, Morgan Hill, Walnut Creek, and Milpitas. It was estimated that each year, a pool

of 4,000 possible in-migrants from these cities combined, was initially available for “attraction” to Salinas (that pool increases over the run of the model).

Area Attractiveness was determined by comparing six factors, weighting each factor, and multiplying that by a competitiveness ratio (Salinas factor score / average score among the five). The scoring was based upon <http://www.areavibes.com/methodology/> city by city comparisons in five of the six factor areas (water availability was not included in this). Areavibes scores (on an A—F grading scale) were based upon data obtained from the U.S. Census Bureau, Google Places, FBI Uniform Crime Reports, Council for Community and Economic Research, U.S. Environmental Protection Agency, and the National Weather Service. For purposes of the module, the A—F ordinal grades were made numeric on a 4—0 scale. Thus, a score of A received a numeric ranking of 4, a score of F received a numeric ranking of 0. To avoid a divide by zero error in creating the ratio of Salinas / City Average for the Cost of Living factor, I converted the average score of F (or 0) for the five cities, to a 0.5 so that dividing by 0.5 gave Salinas twice its nominal weighted factor score, since Salinas does NOT have a score of F / 0 for Cost of Living, and this is a significant factor of attractiveness. On the other hand, because Salinas did receive a score of F / 0 for education, I left that as a ratio that equals 0 until such time as Salinas receives a score higher than 0 (modeled to be approximately eight years). In some cases, the change of factor score was a function of the change in input ratio over time (e.g., Salinas Community Security increased from a factor of 1 to 3 as the ratio of Violent Crimes to Population decreased over a 25 year period as a result of diminishing gang membership, input from another module).





could increase (within system limits) the amount of water derived from desalination and from reclamation. The model could be run from any level of the hierarchy (from the module level to the architecture and Control Panel level), allowing more detailed analysis of each module's output, but the model always ran all modules simultaneously from whatever level it was run.

## F. MODEL OUTCOMES

Key outcomes that resulted from running the model with each module initialized as indicated in the section above are summarized in five year time steps in Figures 13 through 17. Participants were advised not to focus on specific numeric outcomes, since these were based on assumptions made for modeling purposes, rather to assess the trends represented by changes in numeric values in the context of the feedback mechanisms at play within the model.

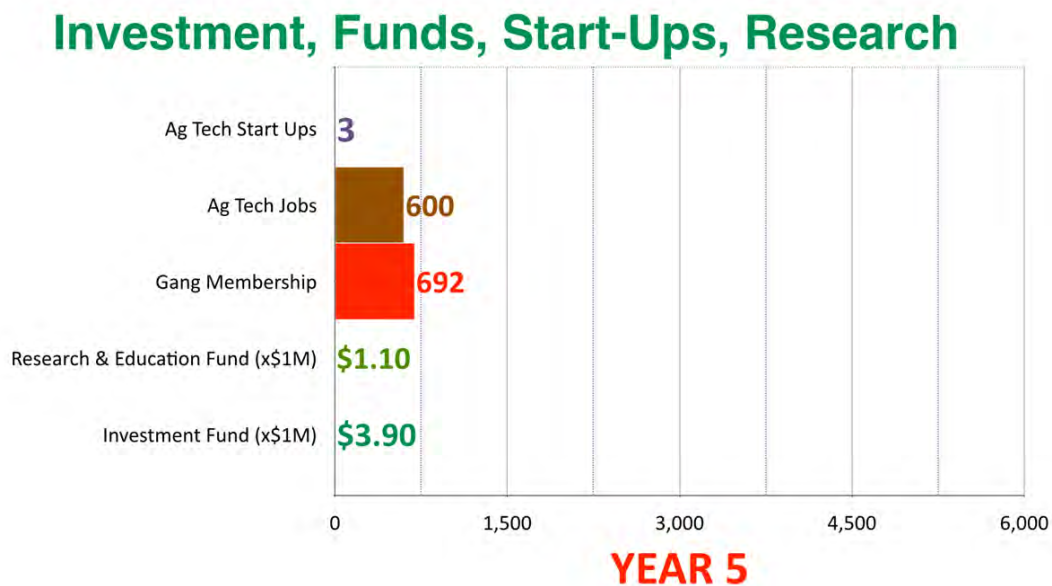


Figure 13. Five Years of Model Run

## Investment, Funds, Start-Ups, Research



Figure 14. Ten Years of Model Run

## Investment, Funds, Start-Ups, Research



Figure 15. Fifteen Years of Model Run

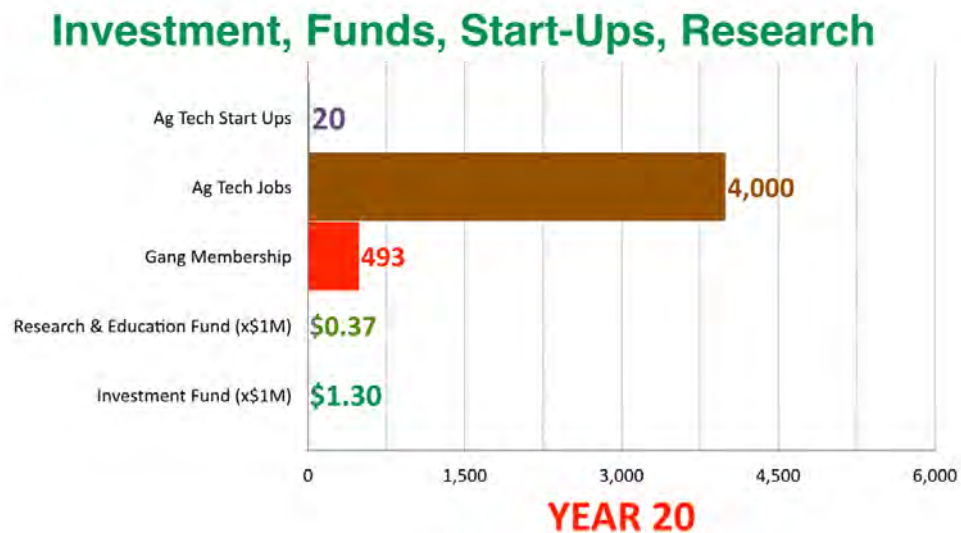


Figure 16. Twenty Years of Model Run

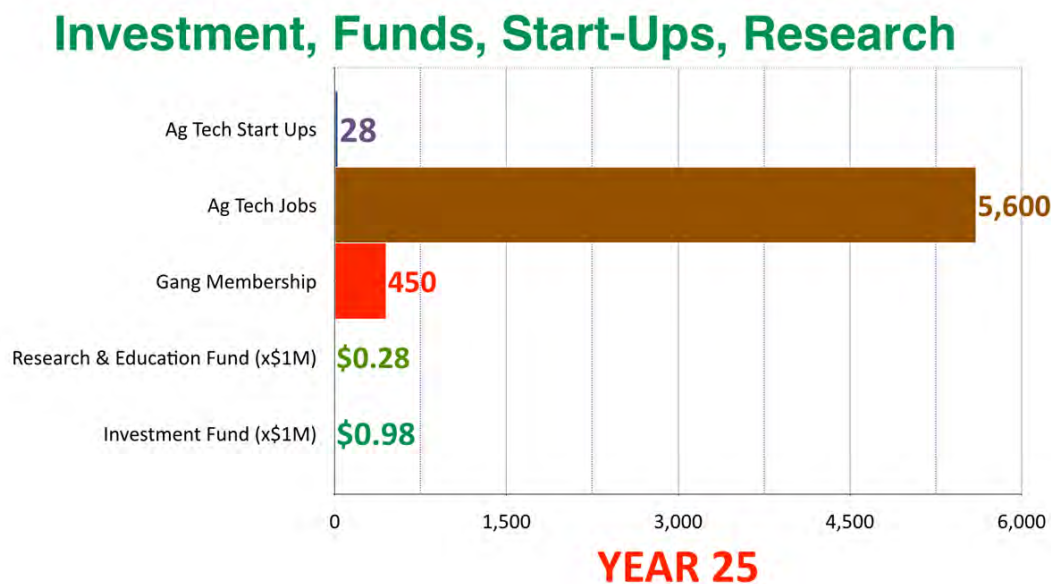


Figure 17. Twenty Five Years of Model Run

By allowing participants to change values of variables with using the Control Panel, different outcomes resulted. In the example below, participants increased the percentage of dollars invested in new start-ups to from 70 percent to 80 percent and reduced the investment in research and education programs (Coder Dojo and Kaufman

entrepreneurial training) from 20 percent to 10 percent. As can be seen Figure 18, this increased investment in start-ups and commensurate decrease in research and STEM programs, resulted in fewer new Ag tech Start-ups over time, fewer jobs and an increase in gang membership.

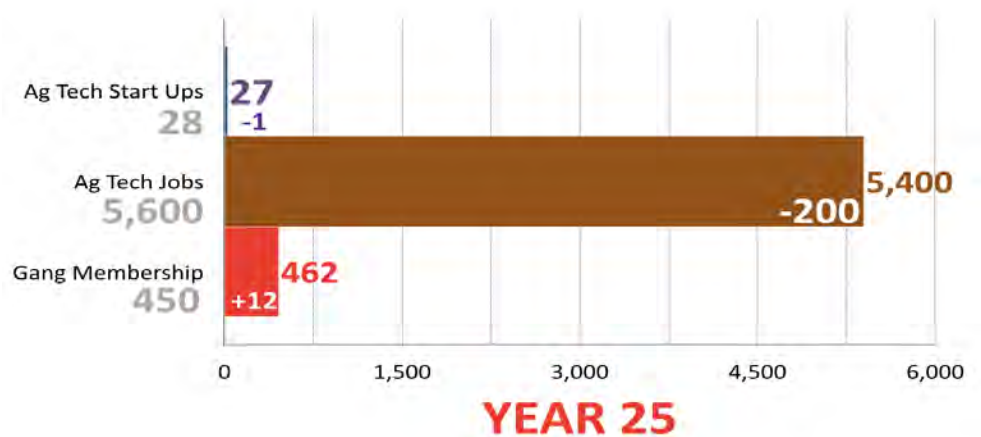


Figure 18. Increased Start-up Investment, Decreased Research Investment

In a subsequent run of the model, participants used the Control Panel to increase the percentage of high school students with access to agriculture technology programs from 17.7 percent to 25 percent. This produced the surprising results represented in 19 Figure, a significant increase in the number of start-ups and jobs as well as a significant decrease in gang membership over the twenty five year run of the model.

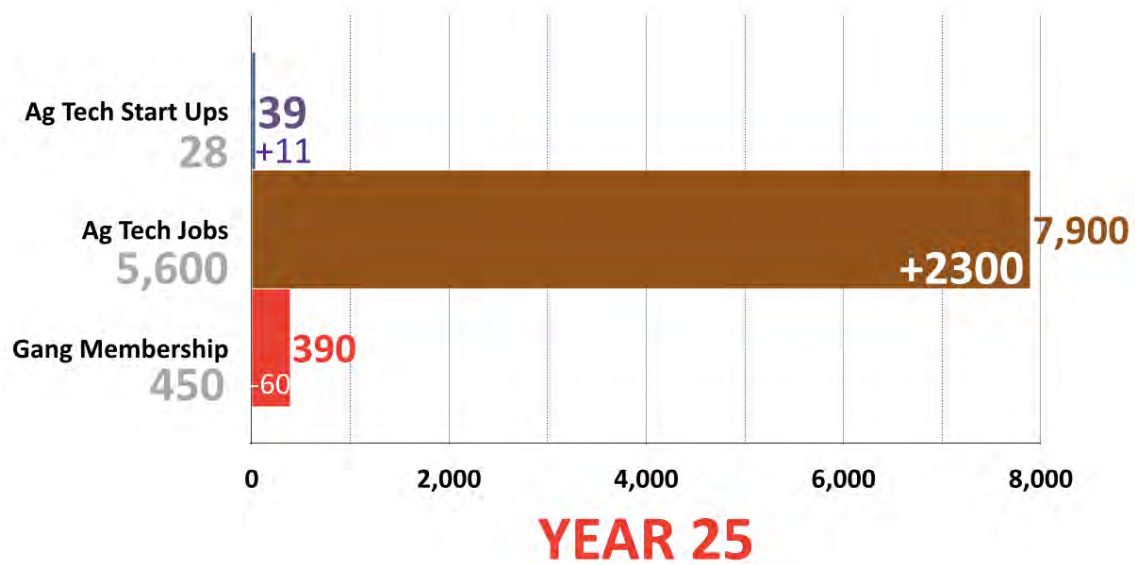


Figure 19. Increase in High School Students with Access to Ag-Tech Programs

The insights gained by the participants interviewed both before and after exposure to the system dynamics model and its Control Panel are explored in more detail in the next chapter.

## **V. ANALYSIS AND FINDINGS**

This chapter covers, in some detail, the players involved in the Steinbeck Innovation Cluster case study, analysis of pre- and post-intervention interviews conducted with participants before and after their exposure to the system dynamics model, a summary of findings based upon this analysis, and a description of the grounded theory that emerged.

### **A. THE PLAYERS AND GROUPS**

In April of 2102, Mayor Donohue recognized the need to assemble a diverse, cross-sectoral group of Silicon Valley and local community stakeholders to address the need for an economic development strategy in Salinas. Initially, the focus was on the crisis created by the closure of one of the area's largest employers, Capital One (CapOne), that had resulted in the layoff of approximately 800 employees in the city's banking and finance technologies sector. Silicon Valley consultant, John Hartnett, encouraged the mayor to assemble as wide a representation as possible from the business, academic, and agriculture communities in order to evaluate the strengths and weaknesses of Salinas that would play a role in defining a strategy for economic development. Regularly scheduled meetings were held with a large and diverse plenary group of area stakeholders, as well as with a smaller core team consisting of Mayor Donohue, City Manager Ray Corpuz, John Hartnett, Salinas Director of Economic Development, Jeff Weir, and Captain Wayne Porter, from the nearby Naval Postgraduate School (see Appendix A, Chronological Narrative of Case Study).

Eventually, participation in the actual planning process was winnowed down to the ten members of the Executive Committee already cited. The strengths weaknesses opportunities and threats (SWOT) analysis conducted by Hartnett, based on insights gained from the larger initial group of invited stakeholders, led the Executive Committee to conclude that what was needed was not just an immediate plan to address the loss of jobs from the CapOne closure, but a long term strategy of economic development that would leverage the identified strengths of the region while diminishing the observed

weaknesses. The Executive Committee of the Steinbeck Innovation Project continued to meet regularly over an eight-month period.

This Executive Committee was tasked with formulating a strategy for economic development in Salinas and the Central Coast region of California, mostly inclusive of Monterey County from the coastal area through the Salinas Valley from north to south County. By design, the Mayor of Salinas had also assembled the Executive Committee with diversity of interests and professional experience in mind. The co-lead of this project, with the Mayor, was John Hartnett, a senior technology executive, investor and advisor from Silicon Valley. Hartnett was contracted by the city of Salinas specifically to develop a plan for economic development.

Hartnett initially brought his employee, Brian Fitzgerald, on board the plenary Steinbeck Innovation team (consisting of key business and civic leaders from the Salinas community) to serve as a coordinator for the Kaufman Entrepreneurial training that was planned to be an integral part of the strategy. Eventually, during the strategic planning process, Hartnett asked Fitzgerald to join the Executive Committee as the Executive Director, focused primarily on operational aspects of the strategy. LuAnn Meador joined the committee as a former local area banking executive and former owner of a winery, with contacts in both the local banking community and the wider California wine industry.

Margaret D'Arrigo, Vice President of Community Development for Taylor Farms, the largest single agriculture employer in the area, joined the Executive Committee as both a representative of Bruce Taylor (the owner of Taylor Farms and a recognized community leader in Salinas ) and as an advocate for community education programs. Margaret's vast background in the local agriculture community and her deep commitment to area public schools and community service made her a natural proponent of the Coder Dojo program for 8—13 year old kids in the community, and for education programs associated with the strategy. Erin Fogg, the owner of a Public Relations firm in Carmel, who had previously done extensive work for Mayor Donohue and the City of Salinas, was invited to join the Committee as a communications expert whose focus was on developing and improving the image of Salinas as part of the strategy. Garland



Thompson, a multi-media director for the Salinas Public Library, was invited to join the Committee primarily to help launch the Coder Dojo initiative and to chronicle the work being done on the city's response to the Bloomberg Mayor's Challenge (described in Appendix A).

Mayor Donohue led the city of Salinas participation in the Executive Committee, but other key leaders from the city included City Manager, Ray Corpuz, and the city's Economic Development Director, Jeff Weir. Together, these three individuals represented civic interests and resources in the development of the strategy. I was invited to join the Executive Committee (the tenth member), based upon insights I had provided in developing a strategy for sustainable economic and educational development for Mayor Donohue in the months preceding the establishment of the Steinbeck Innovation project. It was this involvement that led me to recognize the possibility of conducting action research that could eventually incorporate system dynamics modeling and systems thinking into a case study of the strategic planning process that led to the creation of the Steinbeck Innovation Cluster.

The interviews conducted as part of this research, both pre-intervention and post-intervention (following a demonstration of the system dynamics model of the strategy that I eventually created), were limited to the nine other participants in the planning process cited above. Pre-intervention interviews were conducted approximately 11 months after the conclusion of the strategic planning process, and the post-intervention interviews were conducted approximately five months after that. As mentioned earlier, my coding and analysis of the pre-intervention interviews revealed an interesting dynamic: three clear perspectives emerged from the nine participants. These perspectives can be described as representing for-profit/private-sector, non-profit, and civic interests. Each of these perspectives had three proponents in the Executive Committee: Hartnett, Fitzgerald, and Meador represented what I will call the Private-sector Group; D'Arrigo, Fogg, and Thompson represented what I will call the Non-profit Group; and, Donohue, Corpuz, and Weir represented what I will call the Civic Group.

While there were clearly overlapping interests and commonly shared objectives among these groups, and in-vivo terminology revealed many commonalities in

terminology, the coding also indicated individual perspectives/mental models among the participants, and there was an apparent delineation among the groups in the context within which the terminology was used. As an example, the Private-sector Group frequently used terms related to social good as desirable second or third order effects of sound investment and business development. The Non-profit Group frequently used the term “profit motive” pejoratively and felt that community welfare and involvement had to drive economic development, while benefiting from it. The Civic Group seemed most balanced in recognizing the interdependence and value of both commercial investment and community involvement/benefit to stimulate the economy and raise the standard of living within the community.

Based upon my coding and analysis of participant interviews, I created a simple sector map of participants that illustrated their interrelationships (Figure 20). I also attempted to portray as a combined mental model of the strategy, a causal loop diagram (Figure 21) that reflected positive (reinforcing) and negative (balancing) influences on economic development expressed by the participants in their pre-intervention interviews. Represented in this causal loop diagram are conflicting cognitive biases that can be summarized in the following observations: new business and job growth were seen as driving community development by the Private-sector Group; profit motive was seen as diminishing social good, which was seen as vital to civic growth by the Non-profit Group; and, civic growth was recognized as being the result of both economic development and social good, and promoting profit motive by the Civic Group.

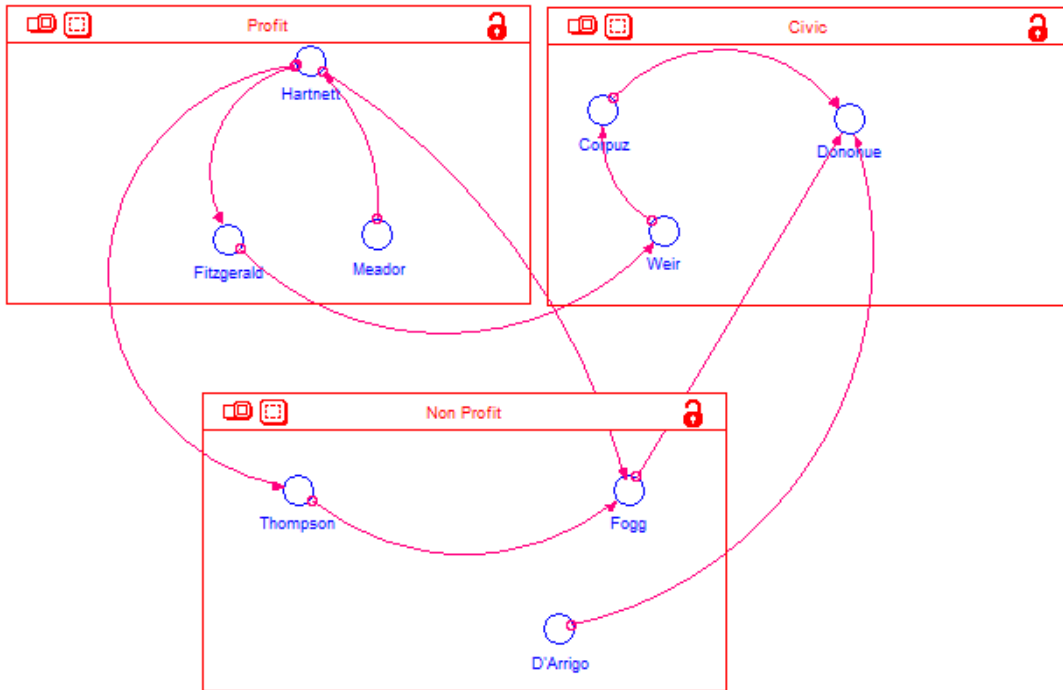


Figure 20. Participant Relationships

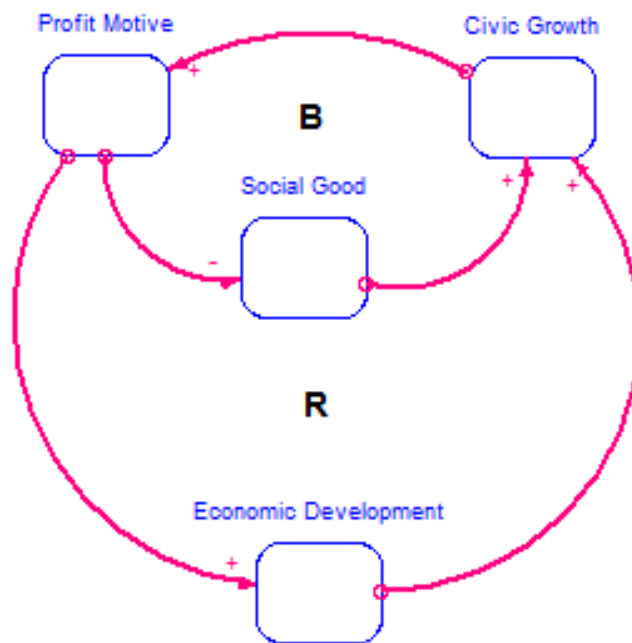


Figure 21. Perception of Group Impact on Economic Development

## **B. PRE-INTERVENTION ANALYSIS, EMERGENT THEMES**

Four themes emerged from first, second, and third phase coding and analysis of the pre-intervention interviews:

1. There are advantages in assembling a diverse strategic planning team and employing a “conversational” (or democratic) approach to collaboration.
2. There are inherent limitations when collaborative strategic planning is undertaken by a diverse, cross sectoral team.
3. Mental models and perspectives can vary greatly among planning participants based upon judgmental biases, and this can lead to policy resistance.
4. Image has both emic and etic aspects for strategic planning; an overly emic perspective can be narrow and self-limiting, there must also be a willingness to accept an outsider’s etic perspective.

Each of the four themes that emerged from the coded interviews will be explored in this section in the context of the three groups that emerged from the coding: the Civic Group, the Private Sector Group; and, the Non-Profit Group. The analysis will attempt to convey significant, though sometimes subtle, differences in terminology and cognitive biases that became apparent distinguishing one group from another. These differences will be revealed through the words of the nine participants largely taken from transcripts of the pre-intervention interviews and through observations made and data collected during the strategic planning process. It should be clearly understood, however, that these “group” labels emerged from my coding analysis and were at no time explicitly recognized by the members of the Executive Committee themselves. Post-intervention interviews and questionnaire results will be used to analyze changes in attitudes, perspectives, and understanding gained through exposure to the system dynamics modeling.

### **1. First Theme—Advantages of Collaborative Planning**

As can be seen in the examples below, two primary advantages emerged from the diversity of experience represented in the Executive Committee: (a) agreement on a common understanding of the strategic environment; and, (b) the development of a broader scope of objectives than would have resulted from a more homogenous group of planners. The first advantage of collaborative planning cited above was manifested

through a common understanding of events and conditions that led to a decline in the economy of Salinas as well as alignment with the Mayor's vision for a way ahead. These two elements could be thought of as defining the strategic environment. Additionally, several objectives were agreed upon by members of all three Groups, almost certainly broadening the scope of the strategy beyond what would have been developed by a more homogenous assembly of planners. Later in this chapter, data from the post-intervention Questionnaires and post-intervention interviews will be used to assess whether exposure to the system dynamics model provided insights that could better leverage the advantages of the process.

*a. Advantage One: A Common Understanding of the Strategic Environment*

What became clear in the pre-intervention interviews of the strategic planning participants was that they all seemed to agree on what had caused the decline of Salinas over the past several years. All participants also accepted Mayor Donohue's vision of linking Salinas to the "pixie dust" of Silicon Valley as the means to attract technological innovation and investment to Salinas and the agriculture industry (participant comments provided in Appendix C).

Agreement on What Caused the Decline of Salinas?

*The Civic Group*

Mayor Donohue believed the decline of Salinas was the result of the national recession that exacerbated shortfalls in city revenue. This in turn prevented essential investment in deteriorating infrastructure and contributed to growing concerns regarding public safety, declining quality of life, and rising gang violence. "Salinas's economy came to a grinding halt thanks to the national economic downturn," he said, "... we simply haven't had the resources to keep up some of our basic infrastructure needs and, more importantly, provide the amenities like parks and sufficient libraries that make a city attractive to perspective employers." He added that there had been an increase in violence that coincided with diminishing resources and had resulted in, "a huge public safety challenge." The City Manager, Ray Corpuz, concurred with the mayor's

assessment, and believed that the impact also affected the agriculture industry's "economic activity," which had follow-on effects throughout the area. The Director of Economic Development in Salinas, Jeff Weir, focused on problems stemming from cultural demographics and the dominant industry, agriculture. He lamented an "apathy" that had resulted in the failure to address socio-economic aspects of education, employment, and quality of life in the community and placed the onus, at least partially, on a lack of support from the agriculture industry. "We do not have support from the dominate industry, Ag, to continue to put money into the community," he said, "we have a \$600-plus million dollar shortfall in investment for roads and sewers and streets and parks, and we are never going to catch up unless we raise more revenue."

#### *The Non-profit Group*

Margaret D'Arrigo, Vice President (VP) of Taylor Farms for Community Development, saw the economic downturn effecting local businesses with unemployment exacerbated by gang problems and the perception of poor school quality. These factors created an environment that was not conducive to attracting new business. Garland Thompson, from the city library, agreed that the recession was part of the problem. Like Jeff Weir, he thought the agriculture companies in Salinas had failed to recognize their responsibility as the dominant industry in the area in promoting community well-being. He explained, "Ag companies have not been interested in investing in or building a Salinas workforce ... so there has been a lack of initiative, a lack of progressiveness, a lack of serious investment in education, in new economic infrastructure." Erin Fogg, who owns Spoke Consulting, cited a vicious cycle in Salinas of economic and social decline, "...needing a better educational system, a better educated workforce, a better supported workforce, and freedom from gang activity and crime which perpetuates the problem."

#### *The Private Sector Group*

John Hartnett, Silicon Valley technology entrepreneur and economic development consultant, saw two converging drivers of decline. He believed the decline in Salinas was attributed to the national recession and a resultant "macroeconomic shift" that was exacerbated by a negative portrayal of gang violence in the local media that discouraged

investment. LuAnn Meador, former banker and wine industry entrepreneur, agreed that the recession had contributed to the downturn in the local economy and described the downtown area as “basically a ghost town.” Brian Fitzgerald, Silicon Valley serial entrepreneur and technology operations officer, placed the blame on an unwillingness to adapt to change. His perception of Salinas was that, “They are an agriculture community embedded in the 20<sup>th</sup> and even the 19<sup>th</sup> century way of conducting business and conducting government...they have no understanding of how to move forward and deal with that in a 21<sup>st</sup> century model utilizing technology, utilizing business possibilities.”

### Agreement on the Way Ahead

#### *The Civic Group*

Mayor Dennis Donohue had for some time hoped to find a way to link Silicon Valley technology and innovation with Salinas businesses, particularly the agriculture industry, to stimulate economic growth. The closing of Capital One, and the resulting loss of 800 jobs, served as a forcing function to begin searching for a recovery strategy. City Manager Ray Corpuz shared the mayor’s focus on bringing technology to the agriculture industry. He thought the vision of linking Silicon Valley to Salinas represented “a turning point” and remembered, “We came to a conclusion that agricultural technology and innovation would be a strength we needed to push.” Economic Development Director Jeff Weir captured the vision by explaining, “Our opportunity for innovation and technology was near at hand, 60 miles to the north, called Silicon Valley.” He believed the imperative of the strategy was to bring Silicon Valley high technology and innovation to the agriculture industry.

#### *The Non-profit Group*

Margaret D’Arrigo viewed the vision as creating synergy between Silicon Valley and Salinas, that would contribute to the area’s ability “to produce more food, more effectively with less water.” She recognized agriculture technology as being the key to the future of the industry. Garland Thompson interpreted the mayor’s vision as representing the marriage of Silicon Valley “to the traditional agricultural economy of the Salinas Valley and the Salinas area...(to) create better jobs for the local community.” Erin

Fogg explained that, “Everyone came in around this vision,” as the means of leveraging the region’s strengths “to elevate a community in Salinas.” Her focus was on providing the residents hope and opportunity for a better future.

#### *The Private Sector Group*

John Hartnett recognized the opportunity of Donohue’s vision from a Silicon Valley perspective. He believed the strategy had to be built on a solid business foundation, and for him, that was “a \$10 billion ag business, one hour south of Silicon Valley.” Hartnett saw “innovation” as the means of linking the strength of agriculture to corporate interests in Silicon Valley that would evolve commercially. LuAnn Meador was unique among the others in the Private Sector Group as a long-time resident of the area. She believed the city had a responsibility to promote economic development that would allow the community to grow. Brian Fitzgerald described the linkage of Silicon Valley to Salinas as the means to increase job opportunity and, “To support the possibility of growing entrepreneurial businesses.”

#### ***b. Advantage Two: Development of a Broad Scope of Objectives***

Having agreed on the vision to link Silicon Valley technology and venture capital to Salinas Valley agriculture as the means of creating an agriculture technology cluster, the Executive Committee then went to work to identify specific objectives to achieve that end. The advantage of assembling a diverse, but small, group of stakeholders is best illustrated by the scope of the objectives the Executive Committee agreed upon. The following six objectives demonstrate the breadth of the strategy developed by the diverse interests introduced by the Executive Committee members and the general consensus that resulted among the members of the three Groups: the Civic Group, the Non-Profit Group, and the Private Sector Group (participant comments provided in Appendix C).



## The Cluster: Linking Silicon Valley to Salinas Valley to Address Global Challenges

### *The Civic Group*

The Mayor spoke of the shared acceptance among the team he had assembled to develop an agriculture technology cluster and to “create a culture of innovation that permeates the community and the region.” He recognized the need to address “food and water issues over the next several decades.” Ray Corpuz further described the purpose of the cluster as demonstrating “how water, energy, and waste could work in terms of this effort for smart farming.” Jeff Weir believed the cluster could address energy usage, waste and water management through agriculture technology to enhance food production and the “growing need throughout the world.”

### *The Non-Profit Group*

Margaret D’Arrigo, with a strong professional background in agriculture and community development, saw an opportunity to revitalize the community and the industry. She said, “The cluster for me was very broad in its scope.” D’Arrigo explained that many of the area’s natural resources were “sort of tapped out” and, as a result, there needed to be technological advances in agriculture. She lamented, “There hasn’t been a lot of change in (the agriculture) industry since drip irrigation which was fifteen years ago.” Garland Thompson, an amateur poet, understood that all the elements represented in building a cluster must “all be working together in beautiful sync and harmony” to make Salinas a better place to live. The concept of creating a sustainable agriculture technology cluster captured the imagination of Erin Fogg. From the perspective of the Non-Profit Group, she said, “I remember some very early conversations shying away from speaking to solving the world’s greatest challenges.” But it was the idea of “finding solutions to these major global challenges” of waste management, water, food and energy sustainability that provided the coalescing vision for the strategy.

### *The Private-Sector Group*

John Hartnett drove the development of the strategy and was determined to make it an executable plan. While his focus remained on new business development, he

recognized a strength in the local community, describing Salinas as, “different than other cities...small enough to be like a village and big enough to be a city.” LuAnn Meador shared his imperative for the cluster to generate business development in order for the community to avoid becoming, “just farm land and agriculture here.” Brian Fitzgerald’s focus was on developing entrepreneurial opportunity, but he remembered, “I began understanding what the cluster was, what the potential was economically, sociologically, financially.”

### A Culture of Entrepreneurialism

#### *The Civic Group*

Mayor Donohue saw the growth of local entrepreneurialism as the means to create opportunity and wealth for the community. He explained, “At the end of the day, there needed to be people, goods and services in the marketplace, creating new opportunities.” City Manager Corpuz drew an explicit connection between economic development and entrepreneurialism and the need to create the “culture and support systems” that would allow innovation technology to thrive. He said, “The entrepreneurial part is key, and you gotta support it with every incentive that you can create, either as a city or bring in from other resources.” Bridging the perspectives of the Private-Sector and the Non-Profit Group, Economic Development Director Jeff Weir understood the linkage between commercial entrepreneurialism and social benefit. He said, “Entrepreneurs can recognize there’s a wonderful opportunity here to do something new and different, that has meaning and value, whether it’s economic or other social or whatever.”

#### *The Non-Profit Group*

Margaret D’Arrigo understood entrepreneurialism in the context of the strategy as the means to attract new business from outside the area. “Seeding new entrepreneurs and new businesses,” she said, “that’s a real key component.” Garland Thompson saw the value of entrepreneurialism in terms of providing individual and community benefit, versus simply commercial gain. Erin Fogg remembered the original vision was to create a

kind of “innovation village” that could “incubate entrepreneurs and start-up companies in Salinas.” She said, “You can imagine this place being the source of all these innovations and creating prosperity.”

### *The Private-Sector Group*

John Hartnett’s professional experience as the Director of an innovation center in Silicon Valley led him to focus the Steinbeck strategy on entrepreneurial development. For Hartnett, the strategy had to be led by the private sector. He summed up his premise by explaining, “If you look at the success of, whether it’s clusters or entrepreneurial endeavors by regions or cities, it’s an entrepreneur is going to lead this.” LuAnn Meador consistently concurred with Hartnett’s approach, of “bringing along your next generation of entrepreneurs that will develop business down the road.” Brian Fitzgerald, who was designated to set up the Kaufman Fast Track entrepreneurial training before being asked to take on the role of Executive Director of the Steinbeck Innovation Cluster Foundation, remembered that an early initiative of the Steinbeck Innovation Project was to “educate people to be entrepreneurs and start businesses.”

### Providing Opportunity Through Education

#### *The Civic Group*

Mayor Donohue saw the need to further develop Science Technology Engineering and Mathematics (STEM), as well as vocational training, in the school system to stimulate and sustain technology innovation and manufacturing. But he was also realistic about the cultural, language, and labor composition challenges confronting the community. He admitted, “We’re gonna be playing back fill, before we turn out a whole generation of STEM kids.” Ray Corpuz tied education to entrepreneurialism and creating a pathway of hope for younger members of the community. For Jeff Weir, education (particularly STEM education) was the key to opportunity and job creation. He explained, as did many others in the Executive Committee, that the lack of opportunity was draining the talent pool. He said that after becoming educated, many young people, “turned away from Salinas because they sought a job, and we didn’t offer those jobs.”

#### *The Non-Profit Group*

The Non-Profit Group was unified in their focus on education as a cornerstone of the strategy. For Margaret d'Arrigo, education was the *raison d'être* for her interest and participation in the Steinbeck Innovation Cluster project and the ultimate foundation of its success. She explained the strategy in terms of creating employment opportunity, encouraging young people to further their education and then to keep them in the community. "The vision," she said, "was economic development, the education piece—getting ag-tech jobs available for kids." Garland Thompson helped establish the Coder Dojo program to stimulate interest in computer programming and STEM technologies for 8–13 year kids as the means of exposing them to more positive options in life. He asserted, "If you don't have a good educational system, you're not gonna have good leaders, you're not gonna have good citizens." Erin Fogg understood education to be an essential element in the overall structure and success of the cluster. "If you don't have a solid education system you don't have a labor force that can then support the companies that are coming in and can start new companies and come up with new ideas," she said, "you don't have that pipeline to continue this into the future."

#### *The Private-Sector Group*

The Private-Sector Group recognized the role of education in sustaining business development. But for this group, education was more narrowly defined than in the other groups. John Hartnett saw education in terms of future growth, "It's opening up the pipeline of innovation both in the short term and the long term." In the short term, he understood the need to promote agriculture technology research, and in the longer term, his interest in education was focused on the two programs being developed as part of the strategy, the Kaufman entrepreneurial training and the CoderDojo. He showed no interest in general public education, perhaps because he believed this to be a purely civic responsibility. LuAnn Meador had seen her own kids attend area schools and then move out of the area for lack of job opportunity, so she was less focused on the development of education than on the development of employment opportunity. Brian Fitzgerald, like Hartnett, was pragmatically focused on the entrepreneurial side of education versus public education in general. "As part of the overall Steinbeck plan, education was going to be a cornerstone," he explained, "not initially at the grassroots level—at the grammar

school, high school, so on—but entering the community at a level to teach folks how to set and structure business.”

### The Need to Collaborate with Universities for Research

#### *The Civic Group*

Mayor Donohue, himself the former Director of the Central Coast Shipper and Growers Association and an executive with a local commercial raddichio grower, was among the first to recognize the value of engaging local universities and colleges in agriculture technology research. He was able to draw Executive Committee consensus around creating memoranda of understanding (MOUs) with academic institutions as a fundamental aspect of the strategy. Ray Corpuz recognized the research MOUs as being critical to sustain the Cluster’s focus on technology and innovation. He explained, “We wanted them to be the pipeline for the ideas, the creativity, to translate, to be able to take those ideas and innovations, translate them and commercialize them into products that would help agriculture, our industry here.” Jeff Weir spoke of “the innovation technology that comes out of research” and recognized the MOUs as being the vehicle for academic outreach.

#### *The Non-Profit Group*

Margaret D’Arrigo felt the research MOUs with academic institutions were a driver for improving the productivity of the region. She saw these MOUs as being “key to our success to move forward in the ag-tech space.” Garland Thomson spoke of “academic thought leaders” providing the impetus of stimulating an interest in technological change in the agriculture industry, which he described as being “more or less static since it began 150 years ago.” Erin Fogg, who had a background working with universities in the non-profit world, saw research as a fundamental aspect of the strategy. She explained, “Institutions and individuals that are committed to the advanced research component are absolutely key and need to be engaged early on this, because they’re the ones who can take those high risk ideas and try to pursue them.” The Non-Profit Group seemed to recognize the relationships with universities as not only generating commercially relevant research, but as providing a source for continued innovation.

### *The Private-Sector Group*

John Hartnett had an observable skepticism about “academia,” driven by a conviction that academics were less focused on practical applications of technology. But he saw the value in collaborating with universities nonetheless, “...ideas come from universities, research will come from universities.” LuAnn Meador dispassionately saw the need to stay connected to university research as the means to develop commercial projects, “tapping into the research minds as a key component, along with the investment.” Brian Fitzgerald likened university research within the Cluster to “product development” in the private sector. He reflected, “That’s the piece I think we should have focused on... using the MOUs with the various academic institutions and then having the connections within Silicon Valley.” For the Private-Sector Group, research was a contributing means to a commercial end.

### Overcoming Local Resistance in the Agriculture Sector to Collaborative versus Competitive Business Practices

#### *The Civic Group*

With his professional involvement in both the City offices and the agriculture industry, Mayor Donohue was perhaps best positioned among the planning team to understand the dynamics and business mentality with the local agriculture community. He recognized that while agriculture businesses in the region, “control or touch” a large percentage of national, value-added fresh food processing, “there’s a decision-making process concentrated in very few hands.” Ray Corpuz understood agriculture technology as the key to future economic development, but viewed local agriculture as a largely competitive industry. He observed that, “For generations, these families had their own growers, farmers, producers, and they dominated the industry here.” He noted a distinct lack of collaboration within the industry, adding, “It was more competitive and, in some cases, more than competitive.” The problem he saw was that the agricultural leaders “were internalized within their own companies, not necessarily looking for partnerships.” Jeff Weir believed there was also an institutionalized reluctance to accept change within the local agriculture industry.

### *The Non-Profit Group*

Margaret D'Arrigo had a unique perspective among the planning participants as a member of one of the most well-established farming families in the Valley. Having served as the President of the Central Coast Grower Shipper Board of Directors, her sense of skepticism was of particular note. "The group that I kind of see moving the slowest is the agricultural community," she admitted. Despite the clear advantages she saw in the Cluster and collaboration, D'Arrigo understood the tight profit margins of the industry. She said to benefit, the agriculture companies would need to invest, adding, "that's going to cost money." Garland Thompson also saw "Big Ag" as the greatest obstacle to collaboration. He concurred that it was the increasing costs associated with agriculture production that had "affected all of their economic decisions." Erin Fogg mentioned a different potential challenge arising from the agriculture community. She foresaw agriculture companies objecting to collaborative approaches to developing intellectual property and new technologies that might threaten their competitive edge. Speaking of the Cluster strategy she said, "I can absolutely see the private sector side feeling threatened or concerned about intellectual property issues or protecting competitive advantage."

### *The Private-Sector Group*

John Hartnett, based on meetings with most of the major agricultural leaders in the Valley, perceived early on a lack of cooperation that could hinder the Cluster's development. Despite being strong companies, he said, "None of them are talking to each other, they're all siloed...kind of like protective companies." He explained that he was confronted with the "the turbulence of corporate politics," that resulted from very closely held, family-run enterprises, adding, "They're holding onto the purse strings of the business." LuAnn Meador, having come from the wine industry, understood the obstacles inherent in competition. She described an industry in which, "There's still a lot of competition within business, of people wanting to get an edge on the other company." She saw this as not only being shortsighted, but concluded, "That competitiveness can actually hurt you, and cost you a lot of money." Brian Fitzgerald viewed the agriculture industry from an outsider's perspective and thought it was more risk averse than the

technology industries of the Silicon Valley. He believed it was “embedded in the 20<sup>th</sup> and even the 19<sup>th</sup> century way of conducting business.” Fitzgerald saw a lack of understanding and a resultant inability to leverage “a 21<sup>st</sup> century model utilizing technology, utilizing business possibilities rather than the old-line governmental and agricultural infrastructure.”

### Cultivating and Exploiting Professional, Academic, and Community Networks

#### *The Civic Group*

Mayor Donohue was himself, a key node in connecting several apparently disparate networks. He personally brought together the Silicon Valley network of John Hartnett, the agriculture network of significant shippers and growers, the Salinas business community network, and my own academic network. He referred to this as “networked agriculture and technology.” Each of these networks had identifiable hubs, or key connectors, that emerged over time and were critical to the Steinbeck Innovation Cluster planning process and strategy. Like all other members of the Executive Committee, he identified the owner of Taylor Farms, the largest agriculture employer in the area, as a key hub in the community, “Bruce Taylor’s early support was critical...to make the case to the industry that this was going to be a unique opportunity.” But Mayor Donohue recognized wider networks, specifically those of academia. He said, “You simply cannot marry ag and tech if one doesn’t come without the other.” Ray Corpuz acknowledged the value of the professional networks that Mayor Donohue, John Hartnett, and the local colleges brought to bear, but he, too, cited Bruce Taylor as the hub for the agriculture community. He saw Taylor as a key connector “to open doors, to open new networks for opportunity.” Jeff Weir agreed that Bruce Taylor and other community leaders were connectors to wider networks, but he also mentioned the value of associations with local educators who brought a network of their own to the effort.

#### *The Non-Profit Group*

Margaret D’Arrigo saw interdependence as driving the need for networking. While she acknowledged the key role her employer, Bruce Taylor, played, she felt the City was increasingly aware of the interdependencies among City and County offices and



the business community. She reflected, “We’re all in this together and we’ve all got to find solutions as a group,” adding, “I think we’re more aligned now than ever.” Garland Thompson saw networks in the context of interpersonal relationships among key stakeholders. He understood the strategy as intended to build “powerful relationships with organizations and institutions, educational institutions, academic institutions... connect up all these thought leaders.” Erin Fogg, a professional communicator, understood the explicit importance of networking perhaps better than most. She described the Steinbeck Innovation Cluster as an “ecosystem of interconnected relationships between the business community, the non-profit community and the community at large, including education and advanced research.” As did the others, Fogg saw networks growing from key connectors, including Bruce Taylor and the universities that had signed MOUs with the Foundation.

#### *The Private-Sector Group*

John Hartnett was also a key connector. In addition to cultivating a network among the local business community, Hartnett, reached out to his own professional network of venture capitalists and entrepreneurs from Silicon Valley. But for Hartnett, Bruce Taylor was the key connector locally, “Somebody has to be the evangelist, and to me, that was Bruce (Taylor).” LuAnn Meador understood the need to engage with leaders from the local agriculture industry, but also to connect with “the Apples, the Googles, the very successful businesses out there that can drive revenue and put the revenue back into the economy.” Brian Fitzgerald had a much more practical, operational perspective of bringing together social services, the City, and business interests in what he referred to as a “matrix managed business unit model.”

## **2. Second Theme—Limitations of a Collaborative Approach to Strategic Planning**

During the planning process, perceived cognitive biases arose among several participants, divided more or less along Group lines that resulted in misalignment and disagreement in identifying priorities. While members of the three Groups generally agreed on the objectives that were developed, representing an advantage of diverse,

cross-sectoral collaboration, two limitations of this approach emerged from pre-intervention interviews with the members of the Executive Committee: (a) disagreement on social benefit versus profit motive as the driving factors of the strategy; and, (b) the lack of a single, identified leader that created ambiguity in prioritizing agreed upon objectives. Later in this chapter, data from the post-intervention Questionnaires and post-intervention interviews will be used to assess whether exposure to the system dynamics models provided insights that could at least partially address these perceived limitations (participant comments provided in Appendix C).

*a.      Limitation One: Disagreement on Social Benefit versus Profit Motive*

It became clear in the pre-intervention interviews that participants brought cognitive biases into the planning process that manifested over time. These biases were most often related to skepticism among the Non-Profit Group of the heavy emphasis on profit motive from the Private Sector Group, and the Private Sector Group's subtle cynicism about projects that were focused on what they perceived as overly ambitious, "pie in the sky" goals. Differences in perspective ranged from addressing the global challenges of food, water and energy sustainability to more local concerns related to the urgency of improving the general quality of life among community residents and the need to embrace academic research and public education. The Civic Group remained, perhaps, the most balanced, recognizing the value of both the Private-Sector Groups pragmatism and the Non-Profit Group's altruism. Examples of these divisions are illustrated in the following divergent perspectives on the approach needed to achieve the strategy's objectives enumerated above.

*The Private Sector Group*

John Hartnett, who had extensive experience in promoting business and technology growth in Ireland, understood the value of forming public-private partnerships to create an environment for entrepreneurs to flourish. For him, social benefit was a positive aspect of the strategy, but he saw commercial growth as the enabler, and was generally skeptical of both academia and the City's ability to play a leading role in job creation. "Companies create jobs," he explained, "it's not governments

and it's not universities." For Hartnett, the City and academia were there to support entrepreneurial growth, but again, he clarified, "It's an entrepreneur is going to lead this, not gonna be an academic, it's not gonna be a city manager." LuAnn Meador was focused on investment and agreed the private sector had to take the lead over the City. She was no more inclined to rely on non-profits to raise money for economic development. "Most nonprofits that I've been involved in only have a piece of the sector," she explained, "and do not have the entire model of how to really hit the home run down at the end." Brian Fitzgerald captured, with some cynicism, the apparent dichotomy between well-meaning and commercially viable objectives. "You want to save the world for democracy," he said, "but tell me... Who is it you're trying to help or who's the customer?" To be commercially viable, Fitzgerald described the need to identify the "profitability and revenue model." He succinctly justified his operational, private-sector perspective, by summarizing, "Well-meaning doesn't equate to success."

#### *The Non-Profit Group*

Margaret D'Arrigo saw the creation of the Steinbeck Cluster Foundation (a 501c3 for public good) as the most important element of the strategy. She believed sufficient money could be raised by the non-profit Foundation, through both donations and investment to fund necessary research through universities and to cover the costs of the Kaufman Fast Trac Training and Coder Dojo, "putting money into the Foundation, so that we can continue to fund the research, get the projects here, get them deployed, get results." Garland Thompson was open in his disdain for purely profit-driven decision-making. He acknowledged the need for private investment but thought "it also has to be done in such (a way) that it's not strictly driven by the profit motive and the profit motive alone." He believed investors had to have a "genuine desire" for their money to do good, that it couldn't just be about "dollars and cents." Erin Fogg provided the most compelling contrast between the Non-Profit and the Private Sector Group.

Erin Fogg was skeptical of an over-focus on profit motive from both the private sector and the City itself. Regarding the composition of the Executive Committee, she alluded to the primary representation "of the for-profit world" in the person of John Hartnett, whom she described as "very much a proponent of using capitalism to move

this process forward.” She also noted, however, that there were representatives from the City offices. Fogg remained focused on non-profit aspects of the strategy from the beginning, and played a major role in ensuring the Steinbeck Innovation Cluster Foundation was a 501c3. She believed it was vital to have the non-profit Foundation understand the “checks and balances we’d have to employ, and how that would benefit and work alongside a city.” Over time, Fogg perceived a shift occurring with the planning team from an emphasis on community benefit to commercial interests. She explained that originally there were three pillars of the strategy: the creation of an innovation village, the establishment of a non-profit Foundation, and the development of a supporting network. She lamented that over time all that had changed. She watched as the “innovation village” concept was morphed by “interests from the Silicon Valley,” into a more traditional business accelerator/incubator.

Fogg described these Silicon Valley interests in the Executive Committee as being “a part of the team that is more profit-focused and private-sector focused,” and she explained that the “network” became a defacto Investment Fund (I-Fund), “brought in by the Silicon Valley team as a structured group of investors and venture capital sources.” She warned against relying solely on what she described as “a siren song that one hears from the private sector,” promising a lot of readily available money and the opportunity to be supported by high-profile business leaders in the community. Fogg made another observation that clearly delineates what she saw as the difference in motives between the non-profit group and the private-sector sector group, “We all see it as a priority in society to continue to push the limits and figure out if we can go to the moon; (the) private sector won’t do that until they’ve seen it demonstrated that it can happen or create some profit.” In stark contrast to Hartnett, she believed only academia was willing to take such risks without looking for monetary reward.

### *The Civic Group*

The Civic Group was clearly attempting to balance community benefit with commercial gain. Mayor Donohue aggressively courted outside investment from the Silicon Valley to stimulate economic development in Salinas, to create jobs, and to generate revenue for city services to improve the quality of life in the community. But he

spoke of the non-profit Steinbeck Innovation Cluster Foundation as being focused on community benefit, and the city's role in promoting and supporting commercial investment. He recognized that, "Ultimately, from the community standpoint... there's the investment piece and then there's (the) Foundation piece, and the Foundation is nonprofit, purposeful, community benefit." Ray Corpuz was clear that the private sector had to take the lead if a public private partnership was to be sustainable. Although he saw the City as being a catalyst, he believed it needed to avoid becoming a bureaucratic obstacle to the private-sector. Corpuz fundamentally was focused on developing agriculture technology through a positive public-private partnership for economic development and job growth. He said, "If we're talking about new businesses and jobs, guess what, government doesn't do that, private-sector creates the jobs... but, we could partner." Jeff Weir spoke of the balance between the private-sector and the community in terms of sustainability, believing the Cluster and the strategy had to thrive "on its own merits," not simply through funding from one source or another. Echoing sentiments from the Non-Profit Group, Weir believed that to be successful, the Cluster "needs to be of human value, more than anything else." While he openly demurred from discussing "all the social belief things I have," he commented that the strategy had to address those in greatest need, helping them maximize their own potential.

***b. Limitation Two: Lack of an Identified Leader and Prioritization***

Another weakness in the collaborative and democratic strategic planning process often cited by participants in the pre-intervention interviews was the lack of a single, adjudicating leader in the Executive Committee. Within the Private-Sector Group, there was a split in opinions of who was, or should be, leading the effort. John Hartnett and LuAnn Meador saw sufficient control residing in the small Executive Committee, with Hartnett, perhaps, as the de-facto leader. This was natural in some sense, because he was the only individual being paid for his role in the planning effort and was specifically contracted because of his vast experience in entrepreneurial technology and economic development. Brian Fitzgerald, on the other hand, with his focus on operationalizing the strategy, was outspoken in what he perceived as the lack of a single leader as the weakest link in the process and the greatest obstacle to success. The Non-Profit Group members

tended to see Mayor Donohue as the central figure for the community writ large, with John Hartnett taking the lead with the business community and investment. The Civic Group members did not address leadership shortfalls, apparently content with the consensus approach taken by the Executive Committee. They tended to see advantages in having John Hartnett take the lead in new business development, and in having the City play a supporting role through specific programs for community outreach, such as Kaufman FastTrack training for entrepreneurs and the Coder Dojo program for young Salinians.

This lack of a single identified leader with adjudicating authority manifested itself through a diminished ability for the Committee to agree fully on the prioritization of objectives. The Private-Sector Group Members saw initial investment in new business start-ups as the proper first step toward the creation of jobs and improved prosperity. The Non-Profit Group members believed an investment in research and improved public education was necessary to lay a foundation of sustainable growth, to off-set concern over growing gang violence, and to gain community support for the Foundation. The Civic Group understood that economic development and opportunity had to be balanced between motives of profit and social benefit, but they understood that investment was necessary to facilitate growth and the health of the community (participant comments provided in Appendix C).

#### *The Private-Sector Group*

John Hartnett did not directly address the lack of leadership in the same manner other participants did, and may not indeed, have seen this as a weakness. He viewed himself in a leadership role in the planning process shared with Mayor Donohue and seemed to believe the limited size of the Executive Committee would provide for sufficient control of the process. He did address the need for leadership in execution, however, and stated that while wider participation in the early days of the process was beneficial, it was only when the Executive Committee was formed as a smaller group that the planning process moved from “discussion and talk to action orientated.” Hartnett saw value in the collaborative or conversational approach taken by the Executive Committee and was satisfied that a consensus would drive a unity of effort. “We seemed to

have...full control of what we were doing,” he said. LuAnn Meador also addressed the power of a small group rather than explicitly citing the need for a single leader. She remembered her concern, however, with Dennis Donohue due to step down as Mayor, and was afraid that there could be a lack of continuity going forward. She described her efforts to strengthen John Hartnett’s position with the City through his relationships with Ray Corpuz and the incoming Mayor, Joe Gunter. Meador clearly viewed John Hartnett as the strategic leader, supported primarily by the City Manager.

Brian Fitzgerald, although a member of the Private-Sector Group, more clearly than any other member of the Executive Committee, detailed what he perceived as the critical lack of an identified leader and the impact that had on the ability to prioritize objectives. Fitzgerald identified John and Hartnett and Dennis Donohue as leaders, both with individual strengths to contribute: Hartnett with a long leadership role in the technology industry, Donohue with community respect and support. But reflecting on his previous experience with strategic planning in the business community, said that while the first step was to agree upon goals and objectives, but that sooner or later decisions had to be made identifying and prioritizing specific projects. He summarized, “It’s a business model, there’s a CEO, or chairman, but for this to move forward then somebody has to be a leader.”

#### *The Non-Profit Group*

Margaret D’Arrigo recognized the dual leadership of Mayor Donohue and John Hartnett, referencing, as Fitzgerald had, the power of their combined strengths. She explained that Hartnett provided great leadership and a new perspective in structuring economic development through his connections in Silicon Valley, and the Mayor brought “passion and drive and commitment.” But the challenges were apparent. D’Arrigo admitted she had underestimated “how difficult it was to build a start-up Cluster, a start-up Foundation.” She recalled that it became difficult for the Executive Committee to “stay on track and stay focused” and began to see staying aligned as the greatest challenge. This was particularly true when it came to focusing on specific priorities. Primarily she saw this as a move away from the importance of collaboration with the universities for research, something she had identified as a key priority. D’Arrigo

observed, “Those priorities have shifted through the process depending on where we were.” Like Erin Fogg, she commented on a perceived shift of focus to the investment fund at the expense of non-profit initiatives. “Building the I-fund has been a number one priority,” she said, “and I think the piece that needs to move closer to a top priority is the funding mechanism for the Foundation.”

Not all members saw the lack of a single leader as a limitation. Garland Thompson consistently viewed the strategic planning process as a democracy of equal voices, though he recognized multiple “leaders” among the group, primarily Donohue and Hartnett. For Thompson, the lack of a single leader was less important than the need to weigh all perspectives as part of the process. He acknowledged the need to compromise, but he justified the democratic planning process by concluding, “No one person is more important than the other.”

Erin Fogg was initially comfortable with having multiple leaders, and commented on the strength of the Executive Committee in developing broad concepts for the strategy, but ultimately she saw the need to “come up with a set of priorities and to- do’s.” Fogg identified most with the Mayor, citing the critical role he played in presenting the strategy to the wider community. She recalled, “John Hartnett...tried to sort of structure and prioritize what actions would happen when, but a lot of it at that point was relatively loose.” Fogg’s confidence that that priorities could be decided by “various leaders” began to flag over time. “I’ve learned how challenging it can be to not have a single leader in an organization,” she said, “and I believe that’s the only weakness that can jeopardize the forward momentum of this.” Although she was originally, “convinced that there were so many powerful stakeholders involved that all of us working together in a coalition could move this whole thing forward,” she said came to realize “that without one sort of central, individual who can make those yay or nay choices” consensus was impossible.

### *The Civic Group*

Mayor Donohue, like John Hartnett, did not directly address leadership challenges in the planning process, “The individuals who originally sat at the table and then the leadership and the key advisors, yourself, John Hartnett, everyone agreed this needed to



be frequent, structured and consistent.” But he came to realize that even with consensus on objectives there are different approaches to achieving them and difficulties with alignment, “Even when people want the same thing, it’s still not easy... even when people who are well intentioned and want the same thing, big challenges are hard.” He concluded, “Alignment is difficult and, when achieved, should never be taken for granted... these are dynamic processes... So, even when people agree, they don’t agree on how they agree.”

Ray Corpuz identified a few key players, but singled out no specific leader among them, “So the key players, obviously, to me were Dennis Donohue, who helped sort of create that opportunity by getting the right people, having a general sense of what the macro picture looked like, (and) a great strategist and a real doer is John Hartnett.” He added, “You (Wayne Porter) were one of the keys because you were able to frame it in a way that made sense of a narrative that created a conversation about this industry and what can happen.” He summarized for me the team’s leadership by saying, “The top three people were you, Dennis, and John.”

Jeff Weir alluded to the important roles played by Mayor Donohue, John Hartnett and others, but did not address leadership within the Executive Committee. “It definitely was Dennis Donohue, the Mayor,” he said, “it was John Hartnett out of Silicon Valley Gateway Partners, it was a couple of educational folks... Wayne, you added even a clearer focus with...the whole clustering.” He alluded to differences of opinion among these leaders, “There were some personalities involved, as there always are... and they were satisfied with having the smaller group effort.” For Weir, the weakness of the planning team was not the lack of a single leader but a lack of broader engagement, “I would have loved to engage a whole lot of people more with your thoughts and views earlier on.” He added, “It isn’t just a single person or entity, it’s so much broader than that.”

### **3. Third Theme—Mental Models and Judgmental Biases**

Mental models varied among participants in the pre-intervention interviews, and although there were commonalities in the overall vision, there were also cognitive, or

judgmental, biases (generally related to expectations for projected outcomes) among individuals and the groups with which they were aligned. As discussed in the Literature Review, Barnes identified several judgmental biases that affect planners and decision makers alike. These include overdependence bias, representativeness bias, hindsight bias, and availability bias (Barnes, 1983; Tversky & Kahneman, 1974). The manifestation of these judgmental biases is explored in this section through three general areas of mental modeling described by the participants: a systemic perspective of the strategy, time horizons over which the strategy would produce results, and theories for implementation of the strategy.

Because mental models vary by person, I have sometimes focused on particular members of each Group who seemed to demonstrate differences among individual and Group mental models where those differences existed. In many cases, the individual mental models of members from differing Groups may have been similar. I have chosen to use only three examples of mental models and to illustrate associated judgmental biases where appropriate: (a) system thinking; (b) time horizon for implementation of the strategy; and, (c) theories for economic development. These mental models will be revisited later in this chapter by analyzing the post-intervention interviews and pre- and post- intervention Questionnaire responses (participant comments provided in Appendix C).

#### *a. Mental Models of Systems Thinking*

In the pre-intervention interviews, before the participants had been exposed to the system dynamics models in detail, very few of them explicitly addressed “systems” or mental models that reflected system thinking. It is interesting, however, that one person in each of the three groups, did cite systems or “ecosystems” in their pre-intervention interviews—Mayor Donohue, John Hartnett, and Erin Fogg. Judgmental biases that are evident in these mental models of system thinking include representativeness bias, in which expected outcomes are representative of the process from which they come, overdependence bias, in which the correlation of variables creates an illusion of cause

and effect, hindsight bias, in which the knowledge of an event's occurrence increases its perceived inevitability, and availability bias, in which a future event is perceived as being likely if it is easy to imagine (Barnes, 1988).

#### *The Private-Sector Group*

John Hartnett described in some detail, his vision of an economic ecosystem with a lifecycle of its own which he then incorporated into the cluster strategy. A hint of availability and hindsight biases was evident in his confidence that the Steinbeck Cluster would mimic the path taken by the Silicon Valley cluster, which he described as evolving over 70 years. He also demonstrated a representativeness bias in his projection that the eventual outcome would represent the process of establishing the strategy with four supporting four pillars: innovation, acceleration, investment, and corporate engagement. Hartnett described the systemic mental model he had of the Steinbeck Cluster as “an ecosystem.” Referring to Silicon Valley in similar terms, he said, “People describe it like a rain forest...something drops on the ground, it's gonna get gobbled up and changed and created into something else...an alive ecosystem.” He explained that while developing the strategy, he envisioned an ecosystem that was based upon an “entrepreneurial life cycle,” that begins with an entrepreneur and an idea, and eventually becomes “a major corporation employing thousands of people and doing billions of dollars in revenue.” His explanation held elements of overdependence and availability biases in tying correlated events to causation through a serialized process of initial funding that leads to technology development and deployment, and eventually scales up through venture capital to an easily imagined outcome.

#### *The Non-Profit Group*

Erin Fogg also conceptualized the Cluster as an ecosystem that would be sustainable over time. This is the same mental model suggested by John Hartnett, so it is reasonable to assume that Hartnett and Fogg had discussed this in some detail when the group was preparing the City's response to the Bloomberg Mayors Challenge. From her non-profit or social benefit perspective, Fogg envisioned the Cluster more broadly than Hartnett, as “an ecosystem of resources, individual expertise, availability of educational

and economic supports that together grow a region of expertise.” Availability bias is evident in her comment that, “As I imagine it, once that is seeded somehow (it) begins to grow on its own.” She also the Cluster evolving on its own, over time, once the agriculture technology had been fielded and demonstrated to be of value. At that point, she added, “we don’t have to ask people to come here anymore, they’re coming because they want to build on that, they want to learn from that, they want to invest more in it.”

### *The Civic Group*

Mayor Donohue had been introduced to systems thinking in our first conversations about sustainable economic development, and I had mentioned it to the Executive Committee on numerous subsequent occasions. He recalled that the systems I had described in our early meetings—education, community security, technology development for manufacturing, sustainable approaches to agriculture—seemed ideally suited to Salinas. That systems approach, he said, “was almost like the perfect mix of things running together.” His projected positive outcomes from the process of systemic planning, reflected both hindsight and overdependence biases, “There are quarters that, if you link them intentionally, can spawn, can bring back manufacturing.” He reiterated his mental model that linked “economic vitality” to the solution of the significant “social challenges” the city was facing. He added, “You cannot, at the end of the day, solve the gang issue, the public safety issue, without economic opportunity, they go hand in hand.” The Mayor concluded, perhaps again with some availability bias of an imagined outcome, that Salinas was the “perfect place to prove systems thinking.”

### ***b. Mental Models of Time Horizon for Implementation***

Each participant had their own expectation or mental model of how long the strategy would require to produce results. Pre-intervention interviews revealed this did not seem to vary by Group, rather it was based upon each participant’s expectation and hope, influenced, again, by individual judgmental biases. I have, nevertheless, provided responses by Group for consistency of presentation.

### *The Private-Sector Group*

As already discussed, John Hartnett viewed the Steinbeck Innovation Cluster strategy in the context of the successful cluster that had developed in Silicon Valley, and he was generally realistic about his expectations for the time such an effort would require. Although initially, based on the availability bias already cited, he hoped for significant progress in the first year or two, he said that as the implementation phase played out, he realized “we’re talking about potentially decades here, certainly five-year type of horizon.”

LuAnn Meador’s mental model was almost synonymous with what she saw as a “business model,” and implementation had a clear start and finish. While she had an optimistic timeline in mind in her pre-intervention interview as noted in her comments below, her pre-intervention Questionnaire cited an 11–15 year time period before significant job growth would be achieved. Representativeness bias was evident in her estimation that the outcome would simply reflect the process, “it’s got a start and it has a finish...you have to get to the end to be successful.” She did, however, accept the reality of a much longer timeline, “more a lifelong project.” Meador displayed an overdependence bias by optimistically seeing cause and effect occurring over a much shorter time period, with the creation of jobs and the support of companies becoming a reality in the second year of the strategy’s implementation.

Brian Fitzgerald, with his operational perspective, did not address a specific time horizon in his pre-intervention interview, but his mental model was one of urgency in the need for action. In his pre-intervention Questionnaire, he cited a 6–10 year time period before significant job growth would be realized. He commented that as a consultant in years past, he had suggested measuring the metrics of success in “Seconds, minutes, hours, and days,” because “you’re not measuring a 40 year plan.” He explained the problem almost in terms of hindsight bias, with the expectation from some community planners that, “Today will be exactly the same 20 years from now.”

### *The Non-Profit Group*

Margaret D'Arrigo's pre-intervention Questionnaire demonstrated availability bias when she selected the very optimistic expectation of seeing significant job growth in the first 1–5 years of the strategy's implementation. This optimism was also reflected in her pre-intervention interview comments. She explained that she had been involved in previous efforts to establish clusters in the area, but that they had all failed. By now imagining a positive outcome, she projected success "because this one has had such incredible momentum." Garland Thompson viewed long term benefit as only accruing over time. In his pre-intervention questionnaire he checked "Unsure" in response to the time required for significant job growth. He confided that he had realized from the beginning that quantifiable results should not be expected "until about a decade or so into it," adding that the Cluster required as much investment in time as money to be successful.

In her pre-intervention interview, Erin Fogg was clear in defining the strategy as a never-ending process, something that continues to evolve over time. She did, however, show signs of representativeness bias in foreseeing progress being made incrementally and quickly. In her pre-intervention Questionnaire she selected 11–15 years as the period of time before significant job growth would be realized, but commented, "I don't think it ever matures and reaches fruition." Her mental model was of an evolutionary process, in which technologies would change and education would contribute to a pipeline of opportunity for local youth. Paradoxically, with some availability bias evident, she then added, "we should see impact immediately." For Fogg, the Cluster represented "a social good experiment" that was rapidly progressing but never ending.

### *The Civic Group*

Mayor Donohue understood the strategy was to create long term economic development and social benefit. He understood it would take time before this could "substantively move into the life of the community and take root." In his pre-intervention Questionnaire he selected 6–10 years before significant job growth could be expected, and he recognized that job growth was a leading indicator for many people in the

community. His imagined result illustrated an availability bias, believing the Cluster strategy represented “the new prototype for how jobs are created,” adding with some caution, “these are dynamic processes.”

Ray Corpuz took a global perspective of the challenges the strategy hoped to address, but he did not cite a time horizon for achieving this. As a city manager he was used to long term planning and saw the Steinbeck Innovation Cluster planning process as being far more dynamic. Demonstrating availability bias in his pre-intervention questionnaire, he chose the most optimistic time period of 1–5 years to see significant job growth. His mental model seemed to take a much broader perspective, citing the growing global demand for food production. He showed representativeness in tying the expected outcome to the planning process and commenting that the Steinbeck Innovation Cluster planning process had been more fluid and less time consuming than previous City projects. With hindsight bias, he concluded, “You can go from one of the most violent places to one of the best places to find a job... I’ve seen it in other communities.”

Jeff Weir selected the shortest time period of 1–5 years for significant job growth in his pre-intervention questionnaire, but spoke of progress and the time horizon more from a generational standpoint in his pre-intervention interview. He cautioned against becoming discouraged by the lack of immediate results. Weir lamented a sort of availability bias that inflated the expectations of many, “We think that’s what is more important...the end result, not the process of getting there,” explaining, that if tangible progress was not demonstrated “within the first 18 to 24 months,” impatience would grow among the population. His own sense of urgency was tempered by a longer term mental model that measured success over 10 to 20 years.

*c. Mental Models for Theories of Economic Development*

During the pre-intervention interviews, each participant was asked to provide a personal theory to improve the long term health and economic development of Salinas. These theories provide some insight into each participant’s mental model and judgmental biases before exposure to the system dynamics modeling of the Steinbeck Innovation

Cluster strategy. Post-intervention interviews and questionnaires will be used later in this chapter to assess the impact the modeling had on these theories.

#### *The Private-Sector Group*

John Hartnett thought the Steinbeck Innovation Cluster strategy reflected well his personal theory for economic development. His reasoning reflects some overdependence on the effect of proximity and other correlations, depending heavily on “the region’s strength in terms of physical assets,” which included a “critical mass of agriculture companies” and a favorable climate. Primarily, Hartnett based his theory on the magnitude of the local agriculture industry and its proximity to the Silicon Valley. Success would depend on selling the Cluster to the “outside world” while “getting the inside world, the community, behind this strategy as well.” LuAnn Meador expressed her theory in terms of the elements being addressed by the Steinbeck Cluster strategy, perhaps showing a representativeness bias in viewing success as the logical outcome of the process. She believed that by “pulling the private and business sector together” with government and education, economic development would follow, “creating a better place to live, making people feel safe.” Brian Fitzgerald portrayed a general theory of business development based on a mental model of a more hierarchical organizational structure. He believed it was necessary to develop a vision, goals, a mission, a plan, and a product. The focus would then shift to finding “support financially so you can carry it out.” He again pointed to leadership as the foundation for his theory of creating an executable approach to economic development. He explained, with some hindsight bias, that what he had seen succeed in the past was leadership that could “define goals and objectives, a viable plan, and then assigning people to move forward.”

#### *The Non-Profit Group*

Margaret D’Arrigo focused on the role of education and technology in her theory. She believed that STEM education was required to support and sustain the development of agriculture technologies needed to increase the productivity of local farm production. Her mental model was based on the strategy’s “model of sustainability” and demonstrating an improvement in energy, water, and waste management. D’Arrigo’s



theory was that by “embracing technology, bringing more technology into the area, and investing in technology” the agriculture industry and the entire county would benefit. Garland Thompson had a clear availability bias with his theory for positive outcomes based on imagining a better future. His theory was that better supporting young families and by making available enhanced educational and cultural programs for all members of the community, an increased quality of life was inevitable. Erin Fogg’s theory was also illustrative of availability bias, believing that if the right conditions existed, a positive outcome would follow. She focused on education as the fundamental building block of sustainable growth, “meaning involving the parents, the communities, and the students.” Fogg believed that in overemphasizing the importance of economic development, there was a risk in failing “to then provide the overall network of growth that will then help create long-term sustainable change.”

### *The Civic Group*

Mayor Donohue also saw correlations among variables as leading directly to identifiable outcomes. He provided an integrated theory of business-led development that could result in the opportunities and resources for a community to flourish. Donohue opined that, “American life, presumes growth and sufficient resources,” and that these were the key to enhancing a community’s quality of life. Ray Corpuz used a mental image of prosperity as the basis of his theory, believing that “if we can figure out how to attain economic prosperity, then I think the rest of it comes.” He elaborated that prosperity and security were directly linked, without the prospect of employment, gang membership and violence were more likely. His theory hinged on leveraging prosperity and diversity, good governance and improved infrastructure. Corpuz’ also used the concept of backcasting (Holmberg & Robert, 2003), imagining a future and working backwards to achieve that, in his conclusion that, “the basic question is what do you want Salinas to be in the future, what should it be doing to help itself to attain that future?” Jeff Weir discussed his theory in terms of promoting opportunity for all members of the community, which he described as “a region of immigrants.” He believed that a strong economy was dependent on providing all members of the community an equal opportunity to maximize their potential. His representativeness bias was that the outcome

is an inevitable result of the process. “I am a product of healthy living, of encouragement, of an opportunity and access,” he explained, “I think we have lost that focus.”

#### **4. Fourth Theme—Image and Marketing**

In their pre-intervention interviews all of the participants mentioned the image Salinas projected to the outside world, primarily through the news media. Many participants who were residents of Salinas or the surrounding area, also addressed the self-image held by residents of the city and the region. I have attempted to aggregate several related concepts within the overarching theme that Image has both emic and etic components that must be considered. Aspects of imaging include explored in this section include: (a) the image of gang violence in Salinas from both an emic and etic perspective; (b) the self-image residents have of Salinas; and, (c) the image the area needs to project to attract prospective residents and investors. As has been noted, there was an emic and etic aspect of imaging and marketing that was implied by many of the participants. Creating the right image for Salinas and the Steinbeck Cluster strategy is explored in further detail later in the chapter when post-intervention questionnaire interview responses are evaluated to determine the extent that system dynamics modeling affected perspectives on the various aspects of imaging (participant comments provided in Appendix C).

##### ***a. The Image of Gang Violence—Emic and Etic Perspectives***

All but one participant addressed gang violence, or the perception of gang violence, as the primary negative aspect of the image of Salinas being projected to the “outside world.”

##### ***The Non-Profit Group***

Margaret D’Arrigo was active in community projects to diminish gang violence through education and rehabilitation programs. She recognized the impact the perception of gang violence was having on the community, citing it as the primary challenge to moving forward with economic development and the ability to attract businesses and residents from outside the area. Garland Thompson believed the negative image of gang

violence portrayed in the press was affecting the community more than actual criminal activity. Erin Fogg, because of her role as the communications and public relations lead within the strategic planning Executive Committee, was more attuned to image than any of the other participants. She linked the gang problem directly to underling social and economic issues that she believed stemmed from an underemployed and undereducated population. “When people are unhappy, unhealthy, unable to support themselves and their families,” she said, “they fall, as I understand it, to gang related activities and crime.”

#### *The Private Sector Group*

John Hartnett had an etic, “outsiders” perspective that brought the media portrayal of gang violence into much clearer focus. He candidly explained, “The only things I knew about Salinas, to be really honest with you was gangs... I didn’t know whether I’d come out after a meeting and my car is still there.” He admitted his initial concerns were entirely based upon media portrayals and came to believe this negative image was being overblown in the press. Hartnett clearly recognized that the image of rampant gang violence had an impact on outside investment and was detrimental to economic development. LuAnn Meador linked the perception of gang violence in the media directly to the difficulty in attracting new businesses to the area. Brian Fitzgerald, who remained focused on operationalizing the strategy, was the only participant who did not address gang violence and community security in his pre-intervention interview. Further, he was the only participant not to cite community security in his pre-intervention Questionnaire as having the greatest initial impact on attracting or discouraging high income earners from neighboring cities (among five choices); he selected, “Unsure.”

#### *The Civic Group*

Mayor Donohue had the most hands-on experience in attempting to address the phenomenon of gang violence in Salinas and the surrounding areas, and was acutely aware of the image being portrayed in the press of violent crime in Salinas. He had long championed community programs to diminish gang membership and to allay public safety concerns. “I always kind of felt we were like the state of Israel,” he said, “we’ll

either be surrounded by our past or surrounded by too many people that have a history of this.” Ray Corpuz did not explicitly address the perception of gang violence, instead he succinctly tied the gang problem, the “severe violence problem with youth,” to a self-image that lacked opportunity and hope. Jeff Weir had the same perspective, linking gang violence to a lack of sufficient opportunity for area youth.

***b. The Self-Image of Salinas***

Understandably, self-image was only addressed by those participants who were residents of Salinas or the surrounding area. This self-image was something the locals believed had to be addressed through positive marketing or branding, which is discussed later in this section.

*The Non-Profit Group*

Margaret D’Arrigo referenced “small-minded thinking” among area residents, something that was echoed by several others. She credited Hartnett with bringing a bigger perspective into Executive Committee. Garland Thompson also reflected a low, small-town, self-image. He thought residents tended to think of their city as “little podunk Salinas” with “not much to do, not much to see here.” He felt too little attention was paid to the City’s major role in raising awareness of the plight of farm workers through the literature of John Steinbeck and in the labor movement led by Cesar Chavez, both of whom had been residents. But Erin Fogg commented on what she saw as a shift in self-image that had already resulted from the strategy. She believed members of the community were now “talking about technology and coding” and that there was more confidence that the city government was actively promoting a more positive image of the city. Fogg thought the focus had very quickly shifted from anxiety over gang violence and attempting to keep “one or two specific jobs in place” to a more forward-looking and expansive discussion. Fogg observed that now, “It’s sort of ‘normal’ that individuals from Salinas should be connected to Silicon Valley.”

### *The Civic Group*

Mayor Donohue alluded directly to the small-town self-image of Salinas, admitting that, “Salinians tend to suffer a little bit from, ‘What do other people think of us,’ rather than what we think of ourselves.” Ray Corpuz did not directly address self-image but he commented on his own perceptions of the area when he took over as City Manager. He said it was obvious that agriculture was the largest industry in the area, but that the City had not come up with a way to take that “value proposition” and use it to their advantage. Jeff Weir saw the negative self-image of inadequate housing as working against the welfare of the community. He said, “The circumstances that people have to live under, it is not safe, it is not healthy, it is depressing as all get out.”

### *The Private Sector Group*

LuAnn Meador was the only participant I associated with the Private Sector Group who is a resident of the area surrounding Salinas. She expressed her own image of Salinas in terms of the challenges it faced, “There’s labor issues; there’s water issues; there’s governmental issues.” She understood that these factors drove people from the area.

### *c. Marketing a New Image*

The concept of “attraction” or “area attractiveness”—addressed by system dynamics pioneer Jay Forrester (1969) in his urban dynamics model—was central to the perceived need to create a new image of Salinas that was stated or implied by all the participants. Much of this new image revolved around “selling” or “branding” the Steinbeck Innovation Cluster as the means to create opportunity and to stimulate economic development. Part of this marketing was specifically focused on gaining community support for the effort, and part of it was aimed at “outsiders.” There was a clear imperative to create jobs and to increase revenue by attracting higher income earners from surrounding communities. This was recognized by all groups, each with its own immediate motives but with the shared understanding that this would result in an improvement in the quality of life for all residents.

### *The Civic Group*

Mayor Donohue recognized that to attract outside investment and talent, the City had to promote the image of an environment that would support this. He hoped the Steinbeck Innovation Cluster strategy would impact not only the self-image but the image projected to outsiders. For Donohue this gain came down to a lack of sufficient resources needed to make key business districts more attractive. This included an investment in infrastructure and amenities like parks and libraries. He commented, “We’re metro in a sea of ag.” He saw smart-farming as “the right shout-out to the tech world, the smarter city, smarter planet, that was the image we wanted to convey.” Ray Corpuz had been focused on the marketing aspects of economic development even before the Steinbeck Innovation Project began. He admitted, “We weren’t selling ourselves very well to the world...it was about branding the city...in an economic development way.” He believed it was necessary to market Salinas as “the capital of the Central Coast, between San Jose and L.A.” as the center for commerce and the government seat. Jeff Weir felt Salinas needed to be honest about the image it hoped to project. “You can fool others, but eventually, if you fool yourself, you fail, he said.” Weir believed the community residents needed to understand that the approach being taken by the city was for the greater good, and they needed to be engaged in the effort.

### *The Non-Profit Group*

Margaret D’Arrigo used the term “messaging” to describe efforts being made to change the city’s image and to gain community support. For D’Arrigo, marketing the Steinbeck Innovation Cluster Foundation was critical. She believed, as stated by Weir, that the message had to reach a broad audience. D’Arrigo thought that residents needed to understand the “the story about why the Foundation’s important,” its intention to fund the CoderDojo program, the entrepreneur programs, “seeding new entrepreneurs and new businesses.” She recognized an opportunity to attract businesses from outside the area that could “synch up with agriculture and be very successful.” Garland Thompson’s approach to changing the image of the city was focused on making it more attractive to the residents as well as to outside investors. Like Donohue, he commented on the need to “raise the budget of the library and parks and recreation department, library and

community services department.” For Thompson, it was a matter of improving the poorest areas of Salinas, without “destroying its natural character.”

Erin Fogg had spearheaded the Steinbeck Innovation Cluster’s messaging effort to the community at large. Her focus had been on making the Cluster’s development a participatory effort, “a place where not only the internal stakeholders could all understand what we were doing, but the community at large could engage with this process and take ownership of pieces of it.” The official introduction of the Steinbeck Innovation Cluster was Mayor Dennis Donohue’s farewell address in December 2012. Fogg put together a pamphlet for that event and developed a website ([www.steinbeckinnovation.org](http://www.steinbeckinnovation.org)) “to let the community know everything that was going on and invite them to start engaging.” She was pleased with the media coverage the Steinbeck Innovation Cluster had since received, explaining that the “the partnership with the Silicon Valley” had garnered news headlines and television news air time. “Now it’s becoming part of the dialog,” she said.

#### *The Private-Sector Group*

John Hartnett discussed his focus on marketing the strategy to create a new image for the city that would encourage investment and entrepreneurial interest. He, too, was pleased with outside press coverage the Steinbeck Innovation Cluster had received, including a feature article in the *Financial Times* (30 June 2013),

For this to be a front page story in the *Financial Times*... (that) has a distribution of 2.2 million people around the world, read by every political leader and business leader in countries around the world, it’s more powerful than the Wall Street Journal.

His impression was that most people in the community now had “a fair idea, that this is the most important thing that’s gonna affect a region.” LuAnn Meador spoke of the need to create an image that would attract investment and development. She understood that, “people aren’t just gonna one day wake up and say, ‘Oh, I want to move to Salinas and I want to build my major plant there.’” She described the outreach that had been done throughout the community to market, and raise awareness of, the Cluster. Presentations had been made to the vintners and growers associations, the Farm Bureau, the Salinas Valley Chamber of Commerce, the city council and others in the private sector from

Pebble Beach to local rotary groups. Brian Fitzgerald was the only participant to raise a cautionary note about the image Salinas was seeking to create. His concern was that Salinas needed to make a distinction between unique aspects of the agriculture industry and Silicon Valley. “You don’t want to replicate the image (of Silicon Valley), and you’re not going to replicate all the technology,” he said. He believed Salinas needed to “build up their own image, their own successes, their own capabilities based on what the core competencies of the area are.”

### **C. POST-INTERVENTION ANALYSIS, AREAS OF IMPACT**

Approximately six months after conducting the pre-intervention interviews, each participant was again interviewed individually and asked to complete the pre-intervention Questionnaire cited earlier. Before the Questionnaire was provided, each participant was asked three additional pre-intervention questions: What caused the decline of Salinas and its economy; What are the most important factors that need to be addressed to improve the health and viability of the region; and, What is your theory that explains why you favor addressing what you think is the most important factor? As stated, the participants were asked to complete the Questionnaire before and after exposure to the system dynamics model. Results of these pre-intervention responses were folded into the observations noted in the preceding section.

Following exposure to the model—which included a detailed explanation of its feedback mechanisms, the data that was used to populate the model, the process used to validate the model’s structure and content, and a demonstration of the model’s ability to run key parameter value changes over a twenty-five year period—the participants were interviewed to determine the model’s impact on their understanding of the strategy and its implementation going forward. Post-intervention observations are evaluated in this section in the context of three Areas of Impact that emerged from coding analysis of their responses: (1) insights gained; (2) sub-systems within the strategy; and, (3) potential applications for the model. Of note, there was a great deal of commonality or concurrence



among individual participants in each Area of Impact, making cognitive differences among the three groups more difficult to discern (participant comments provided in Appendix C).

## **1. Insights Gained**

Each participant emphasized a number of insights the models had provided them. Most common among these were clarity, the use of data, interrelationships among the five modules, re-evaluation of priorities and time horizons, and greater focus. Insights gained are explored below through the comments of participants in each of the three Groups identified earlier: the Private-Sector Group, the Non-Profit Group, and the Civic Group.

### *The Private-Sector Group*

John Hartnett addressed many aspects of insight gained from the model that were commonly cited by others. Most importantly perhaps, the model provided him the “wire structure” that tied the strategy together, providing clarity and an enhanced understanding of interrelationships among the systems the strategy was intended to affect. He thought the Control Panel was particularly helpful in allowing him to “dial” up or down certain model inputs to judge their effect on the system of systems over time. He added that just considering which elements of the strategy he could realistically expect to control (e.g., percentage of investment in new business start-ups versus research) gave him a much better understanding of the impact this would have on job creation. The data used to populate the model were also important for Hartnett, who admitted to being initially skeptical that data could be used to realistically evaluate trends over time. Another area of understanding that was enhanced for Hartnett was the feedback within and among the modules, providing clarity in terms of cause and effect across the systems. Overall, for Hartnett, the model provided a framework within which to better structure the strategy. He explained, “We drew the strategy together from past experiences of what can be done combined with more intuitive and theoretical (thinking),” adding “this almost makes it real.” Hartnett saw the model adding coherence and a grounding in reality. He

commented that the model had connected all the dots, and reminded him that implementing strategy, in reality, always winds up costing more and taking longer than originally planned.

LuAnn Meador believed the model reinforced the strategy that had been developed, when there had been little understanding of the effects the strategy might produce. She said the model added clarity for her in better understanding how to proceed with implementation, particularly the need to create a more efficient division of labor and synergy among the Foundation members.

Brian Fitzgerald, who seemed to have the most pragmatic and operational perspective among the participants, saw the model as enhancing the understanding of decision makers, citing the enhanced understanding of feedback as the most important aspect. He explained that it provided the means to better understand areas of focus and opportunity for problem solving. He added, “The instantaneous clarity...it just jumps out.” Perhaps the greatest insight for Fitzgerald was the modeling tool, itself. He said that many of the models he had seen used in industry consisted of “a lot of numbers of pie charts,” providing little insight into the underlying issues or opportunities. He believed the system dynamics model moved the development of strategy from “drawings on a white board” to a tool for evaluating risks, rewards, and capabilities. For Fitzgerald, the value of the model was that it linked strategy to operations.

#### *The Non-Profit Group*

Margaret D’Arrigo said the system dynamics model had changed her mental model of the time required to accomplish the strategy and provided greater focus going forward, making her think in terms of a 15 to 20 year time horizon rather than what she had hoped would be five to seven years. She now believed the strategy would require 15 years or more to really “shift things in a major way and make a major impact.” D’Arrigo thought the application of data provided clarity that had been absent, and the fact each module had been validated by “very credible sources” allowed her to trust the results. For D’Arrigo, the interrelationships among the modules provided the means to better prioritize objectives, in terms of investment, education, and research. Although she said

the model had validated her own belief that education and research were key priorities, it provided her the ability to better assess trade-offs.

Garland Thompson concurred that the model provided validation of what he suspected based on his experience, but he said there were aspects of the strategy (e.g., the impact water availability could have on growth) that he knew very little about. Understanding the structure used to build the modules helped him better understand their behavior, adding that the use of actual data added clarity and a degree of validation where he had previously only had anecdotal evidence to support his intuitive beliefs. Thompson also thought the data contributed to a greater understanding of feedback mechanisms within the systems addressed by the strategy, particularly over a 25 year time horizon. He saw the model as providing a great tool for pattern recognition. He said the feedback mechanisms represented in the model contributed to a better understanding of interrelationships among stakeholders and the systems themselves.

Erin Fogg admitted to having come into the process with “biases heavily weighted towards research and education as being the primary driver.” After seeing the model she had a much greater appreciation of the impact STEM education and high school access to agriculture technology curricula could have on area youth, particularly in offsetting gang membership and increasing job opportunity. Referring to an enhanced understanding of the feedback mechanisms, she added, “What the models have done is better clarify how all of the different elements that have been at play from the start interact with one another and how those should be prioritized.” Fogg gained a better appreciation of the networks she had discussed in her pre-intervention interview, as well. She said she found herself thinking about the strong link between interconnected networks and the role they could play in the Cluster, something she now saw as a critical element for the Cluster’s success. The 25 year time horizon of the model resonated with Fogg, who thought it made sense to think that far out. She said the model had “turned on its head” the important pieces of the Steinbeck Innovation Cluster she needed to convey in a communications strategy.

### *The Civic Group*

Mayor Donohue appreciated the value the model provided in adding substance to the systems approach to strategic planning. He found it “eye opening to actually see it in action.” He said that in terms of viewing the future as an “integrated ecosystem” the model had clarified how interconnected the various systems are, commenting, “If a picture is worth 10,000 words, this is worth 100,000.” The Mayor thought the model’s use of data provided validation for the strategy and opened a dialogue space that had not previously existed among the various stakeholders. For Donohue, the model also provided validation for his vision to provide “wealth creation opportunities,” but it had changed his expectations for the time required to achieve this. He admitted that he had been “a little naïve,” by envisioning a three to five year period in which “dozens of young companies and hundreds if not thousands of jobs” could be created, it could take much longer.

Ray Corpuz saw the model as reinforcing beliefs he held that were based on experience and intuition, but added insights into the elements that affected anticipated outcomes. He appreciated the clarity the model provided particularly in the area of feedback mechanisms within the systems over time, explaining that caution was needed to avoid unintended systemic consequences. The use of data caused Corpuz to reflect on the thinking that had gone into the strategy, concluding that “there were some missing pieces in terms of how much to invest and how important was the Ag labor, technology, education component.” He felt the model had provided “empirical evidence” that contributed to a “more grounded” understanding. Like the others, Corpuz found the model had changed his mental model of the time horizon required, from a five year plan to “more like 15 to 25 years.”

Jeff Weir appreciated the clarity the model provided in terms of understanding the “complexity of the relationships.” He thought his past experience bore out the model’s validity and reinforced his sense that the strategy would require time and “the right strategic decisions” if it was to succeed.

## **2. Understanding Sub-systems within the Strategy**

In interviews following exposure to the system dynamics model, participants addressed specific insights gained from several of the individual modules, or sub-systems of the integrated model. I have broken these observations out from the insights cited above to provide an additional level of specificity to their enhanced understanding of feedback mechanisms at play within the strategy and the potential non-linear outcomes this feedback produces. The two modules that seemed to produce the most surprising, or illuminating, impact among the participants were the Water Management and the Ag Tech Education Modules. The two modules that seemed to elicit the most interest in their integration within the overall strategy were the Attractiveness and Gang Membership modules. The shift in focus the model produced from investment in new businesses to the importance of research and education was most significant in the Private-Sector Group, and after running the model all groups recognized the value of Access to Ag-Tech Programs in High School and the impact on economic growth Water shortages could have.

### *The Private-Sector Group*

John Hartnett was impressed with the feedback between the Education, Gang Membership, and Investment modules. His comments on the long term impact that research could have on economic development and the impact education could have on the diminishment of gang activity represented a significant change in attitude from that voiced in his pre-intervention interview. Hartnett said that before seeing the feedback within the systems of the model he believed there was very little the strategy could do to positively affect the gang situation, but that now he recognized the impact education programs and job opportunity could have. He found it uplifting to think he had the ability to impact the lives of young kids. Hartnett was most surprised by the impact the Water module could have on attractiveness and long term growth, describing the modeling results as “jaw dropping.” He explained he had always considered water availability to be a low priority but that now he recognized it as being fundamental. He said the model had helped him re-order his priorities. Hartnett spoke of insights he had gained into the interrelationships among the Water, Education, and Gang Membership modules in terms

of their potential impact on business interests. As expected from this pre-intervention interview, he projected the model outcomes onto potential impacts on investors, “If you look at who the biggest winners and losers are, it’s going to be business.” On the other hand, his comments on education and social benefit seemed more pointed and significantly different than in pre-intervention interviews and conversations. He said, “You’re just connecting all the dots for me, but kind of putting it in a more precise fashion... I mean, the whole area of education, obviously high school and third level education I think is crucial, and investment in research.”

LuAnn Meador was most affected by the Attractiveness module and the impact quality of schools had on this, with the model demonstrating a direct link between the two. She further recognized the feedback among the Education, Gang Membership, Investment, and Attractiveness modules, with tailored education contributing to a diminishment of gang violence by promoting agriculture technology in job creation and by attracting technology professionals from neighboring cities who could contribute to the City’s resource shortfalls through property and sales tax revenue.

Brian Fitzgerald thought the Education module and its integration in the overall system of systems tangibly validated common intuition that education impacts community success. The Attractiveness Module caused him to consider the reality of what was needed to bring people and money into the area, changing his perception of “attractiveness” from what he termed “kind of warm and fuzzy,” to “a real fit, form, function, cost result.” Further, the integrated modules caused Fitzgerald to recognize the impact of education on attractiveness and in addressing the need to develop a thick labor pool for new business development. He commented that the model reinforced the fact effecting change in these systems was long term effort that went beyond short term programs that are only useful for a “specific period of time.” Fitzgerald also voiced surprise with the potential water had to impact the other sub-systems within the overall strategy. He explained, “The whole water piece of this... just jumps out...if you do not have a sustainable environment, you will not have education, you will not have attractiveness.” For Fitzgerald, the model provided the means to “plot” where problems could begin to arise so that they could be averted.

### *The Non-Profit Group*

Despite her personal involvement in local public education, Margaret D'Arrigo expressed shock at the impact the Education and Attractiveness modules indicated quality of schools had on attractiveness. And even with her extensive experience in the local agriculture industry, she found the Water module brought to light aspects she had not been aware of previously, specifically the fact that all reclamation water is used for irrigation. The Gang Membership module simply reinforced her intuitive understanding of the situation and work she had done in the community to raise the level of awareness, particularly the value of introducing STEM technologies to younger children. She understood the impact feedback from various modules had on the Attractiveness module, and the model enhanced her understanding of the conditions that promote area attractiveness for outside businesses.

Garland Thompson focused on three areas that impacted attractiveness—water, gang membership, and education. He was most surprised by the impact water could have on the overall strategy. He said the Water Module had added clarity on the percentages of water required to meet agricultural, residential, and commercial demands. He identified water as “the real driver” and said the model provided the means to make more informed decisions about its use. The Gang Module contributed to his understanding of impacts on specific age groups, specifically the need to address younger children at risk. The feedback between the Education and the Investment modules also provided Thompson insight into the direct affect tailored education in high school could have on the labor pool required to promote new business start-ups. The Education module’s impact validated his conviction that education was the fundamental sub-system on which to focus. Bringing all the modules together, he added, “Bottom line, education,” citing the significant impact it could have on other sub-systems in the model.

Erin Fogg remained convinced that investment in education and research was more pressing, at least initially, than investment in new business development to promote sustained growth. Changing values in the Investment module Control Panel provided Fogg a sense of validation, by demonstrating that a 50 percent reduction in funding over the first 10 years had “relatively little impact” on the number of new business start-ups in

that same period of time. She found it “reassuring” that, “as long as you don’t pass a certain threshold,” the initial lack of funding “may not totally inhibit success of long-term growth.” The feedback among the Gang Membership and Attractiveness modules changed Fogg’s mental model of cause and effect. She found that Gang membership was something that could be addressed indirectly by other controllable elements of the strategy rather than needing direct intervention. She was also surprised by the impact the Water module could have on the Attractiveness module and population growth.

### *The Civic Group*

Mayor Donohue found the constructs within the Attractiveness Module of particular value in bringing to light aspects of the strategy he had not fully considered, specifically the factors that contributed to increasing the revenue base by attracting agriculture technology professionals to Salinas from nearby cities. The Water module’s feedback into other system modules provided the Mayor (and commercial radicchio grower) a greater understanding of the effects created by failing to address water shortages. The former Mayor appreciated the concept of “STEM Inoculation,” introduced in the Gang Module, that suggested Coder Dojo students who had been exposed to STEM technologies at an early age could be “inoculated” against being recruited into gangs when they reach high school. He thought this should become a central theme in the strategy.

Ray Corpuz, as City Manager, was most interested in the Attractiveness module, and negative impact a low score in Quality of Schools was shown to have on attractiveness. He further appreciated the impact feedback among the Investment, Education, and Gang Membership modules had on the Attractiveness module, in terms of community security, the promotion of agriculture technology, and the development of a skilled labor pool to incentivize new agriculture technology start-ups. He said the model provided clarity of the interrelationships among “private sector investment” and “public sector quality of services and revenue” that were needed to “mitigate some of the impacts of either gang violence or other externalities that cause some problems in a local community.” Corpuz gained further insights from the Investment and Education modules regarding their impact on the labor pool and new business start-ups. He explained that the



model had demonstrated the need to positively influence children at an earlier age to offset gang membership and violence, but also to develop skills needed to encourage investment and business development. He specifically cited the importance of agriculture technology programs in the high schools. He further noted the different behavioral outcomes produced by changing investment settings in the Control Panel, commenting, “When you compare the investment in research and the investment fund, how telling that is between those two.”

Jeff Weir also found that feedback between the Education and Attractiveness modules demonstrated the need to generate a skilled labor pool to incentivize and sustain new businesses. He said the connection between the Education and Investment modules helped him better understand “the relationships of the factors” involved. He, too, appreciated the Water module’s ability to underscore the impact water availability has on area attractiveness. As Economic Development Director, the Investment module validated for Weir the importance of investment funding that would “drive everything else.”

### **3. Potential Model Applications**

In post-intervention interviews, participants most often discussed two general potential applications for the system dynamics model, as a decision tool and as an information/marketing tool. The model’s usefulness as a decision tool was seen as providing the means to better prioritize objectives within the strategy and the resources needed to implement the strategy. As an information tool, the model, and the data used to initiate the modules, were also recognized as having the potential to bring various stakeholders to a consensus on issues that might otherwise be overly contentious, whether in planning or in execution. This use of the model for presentation purposes was cited as having the potential to increase collaboration and to generate unity of effort, particularly among city officials. As a marketing tool, several participants saw the value of using the model to better “tell the story” of the Steinbeck Cluster strategy to a variety of audiences, in both the public and private sectors, locally and beyond.

### *The Private-Sector Group*

John Hartnett was primarily focused on the model's ability to help decision makers prioritize objectives and resources, specifically the use of data to illustrate behavioral outcomes of feedback within the structures over time. He explained that, "when you of put all those pieces together you can see the house that you're trying to build, whereas, we were kind of looking at the blocks." Hartnett recognized the model's potential as an information/marketing tool to generate interest among investors and the community at large, specifically related to water, and said he would like to use the model in an upcoming investment summit focused on water issues in the Salinas Valley. He also spoke of models information/marketing value in describing the value-proposition of the Steinbeck Innovation Cluster. As a decision tool for alignment Hartnett concluded, "This is a great way to project the problem out into the future to get everybody back together."

LuAnn Meador, who had been most involved in raising money for the Steinbeck Innovation Cluster Foundation and for the Cluster's business accelerator, was primarily interested in the model's potential as an information and marketing tool. She envisioned using the model in a "campaign around education" to better inform the community, the business sector, and city and county officials. Meador thought the mode could provide an "ah, ha moment for many people" in better understanding the potential positive impact education, attracting higher earning residents, and promoting agriculture technology could have on the community. As a decision tool, Meador proposed sharing the model with the business community and local governments in order to focus priorities and "to identify some real strategic plans and initiatives." As a funding tool, she thought the model would broaden the scope of the money raising effort, beyond "one initiative or another" to "raising money for the whole concept." She also clearly articulated the value the model could offer in aligning differences among the Executive Committee members and as decision tool for prioritizing objectives. She described the Steinbeck Innovation Cluster Foundation members as being "a little bit fragmented" with different personal agendas, and hoped the model could bring consensus to the group.

Brian Fitzgerald was perhaps more enthused by potential applications of the model than any other participant. Coming from an operational perspective, he articulated

a spectrum of decision support applications for quite a variety of purposes and stakeholders, from planning through execution phases of the project. “It is a great ‘what if’ tool,” he said, “to create a new policy, a new process, a new educational model.” He expounded that the system dynamics model was not only “a great decision maker tool,” it was an “innovator’s dream.” He explained that based on his experience with strategic investment, he had never seen a tool that so clearly demonstrated complex cause and effect and that allowed for calculations that might modify the outcomes. As a decision tool, Fitzgerald saw the model providing the means to look beyond monetary considerations to the effect on the “infrastructure of the community” and its potential to grow. Regarding the model’s ability to inform prioritization, he said, the model could allow for “informed decisions” to be made sooner. While he admitted, the strategic planning process would still involve “hair pulling discussion of what are you trying to accomplish,” he thought the model would be useful to align priorities within a group environment with “less trial and error.” As a presentation or marketing tool, Fitzgerald saw the benefit for potential investors, impressing on them the need to look beyond “short term solutions...for the quick pay back.” He thought the model could demonstrate “value added on value” over the long term. Fitzgerald also believed the model would contribute to a shortening of the time required to move from strategic planning to execution. For Fitzgerald the model provided the means for potential investors to better assess risk versus reward. “Anytime people are writing checks, the more comfort level, the faster you get the money and the more you get,” he concluded.

#### *The Non-Profit Group*

Margaret D’Arrigo referred to the model’s potential for marketing the Cluster’s concepts to stakeholders across the community, specifically providing more focus on the need to invest in agriculture technology for job creation. She enthusiastically believed, “everybody should see it,” agriculture business owners, universities, high schools. She added, “High schools would be really key,” because she suspected educators and administrators “may not realize the impact” their work has not just for an individual child “but the entire community and its ability to attract and grow and prosper.”

Garland Thompson saw the primary value of the model as a decision tool for the civic leaders of Salinas, “not in a predictive way, but as far as defining the most important factors and how all the factors affect each other.” He opined that without the “clear understanding” provided by the model, “good judgments about policy” were difficult and were often based on “anecdotal evidence” or on appeasing their constituents during an election. He also recognized the model’s informational value in enhancing expectation management. He thought there had been a misperception in the media about the time frame required to achieve the Cluster’s objectives for job creation that could be addressed by sharing the model with both “the public and the policy makers.”

Erin Fogg commented on the model’s potential as a decision tool to better align priorities among the non-profit and private sector interests within the Executive Committee. In considering the model’s impact, she said, “Looking at the group dynamics, I can see within the next few months the possibility of things shifting again such that the investment piece is separated some from the social, educational, or research, non-profit, city, municipal piece.” In hindsight, she added that had the system dynamics model been available during the strategic planning process, “it absolutely would have changed the group’s priorities.” Fogg also addressed the model’s informational potential to bring a variety of stakeholders together for more collaborative implementation of the strategy. She thought that sharing the model with “the chief of police, other city representatives, the superintendent of schools” would enhance their understanding “of where they are in this interconnected structure of pieces that they need to move forward.”

### *The Civic Group*

Mayor Donohue spoke of the model’s strength as an informational marketing tool to expand understanding and generate interest in the Cluster strategy. He saw the need to “get this in front of the right group of stakeholders as quickly as possible.” Specifically, he said the education community and local businesses would benefit from seeing the model, and that could lead to “a pretty interesting public dialogue.” Like Thompson, he commented on the model’s ability to better manage public expectation about the strategy’s time horizon, explaining, “I think that any tool that gets people to where they need to be in terms of managing expectations is really, really critical.” The now-former

Mayor also saw the model as a decision tool for the City leaders to help better manage resources and as the means to justify their demands.

Ray Corpuz spoke in practical terms of the potential for the model to break down barriers within departments of the City government. He thought as a decision and information tool, the model could help in “breaking down those barriers between education and city government, or breaking (down) those barriers between the investors and the city.” Corpuz envisioned the City, “taking the lead to help position the marketing of what we need to do” and in explaining the importance of becoming “the agriculture technology hub.” As an informational tool, the City Manager agreed with others, that the model could help define for educators “connection of the dots between what they’re doing and Ag-Technology and how they could help that.” As a marketing tool for investment, Corpuz thought the model could be the means to reach “all the people that have money sitting on the sidelines, whether they are a VC or Angel fund or they’re a corporate entity.” Finally, as a decision tool, he concurred that the model could be used “as a way of communicating what needs to be done and prioritizing, so we’re a little smarter in how we look at the total system.”

Jeff Weir cited the model’s potential for presentation purposes to generate a collaborative effort by better explaining the strategy. He opined, “This model can help people better understand not only the importance of the variables, but the interactions” between investment, education, and job creation. As a decision tool for “more strategic thinking and planning,” Weir found system dynamics modeling to be “the way you should do it.” As the means to increase synergy among stakeholders, he hoped “the folks you have engaged to structure the model could now come together and see the value of understanding more clearly what is going on and the real importance of working together.” He concluded, “It would help accelerate people coming together and working together.”

#### **D. SUMMARY OF FINDINGS—THEMES REVISITED**

Analysis of pre-intervention and post-intervention data, explored in the preceding sections, revealed that exposure to the system dynamics model significantly impacted the

participants' perceptions of the Steinbeck Innovation Cluster strategy and approaches to its eventual implementation. Specifically the model enhanced participant understanding of dynamic complexity (how the state of the systems within the strategy change over time), structure/behavior relationships (how the feedback mechanisms within the systems of the strategy interact over time), and policy resistance (how short term "fixes" may have long term unintended consequences).

Based upon the analysis in the previous sections, the system dynamics model appears to have influenced participant thinking in each of the three themes that emerged from the coding of pre-intervention interviews:

1. There are advantages in assembling a diverse strategic planning team and employing a "conversational" (or democratic) approach to collaboration.
2. There are limitations inherent when collaborative strategic planning is undertaken by a diverse, cross-sectoral team.
3. Mental models and perspectives can vary greatly among planning participants based upon judgmental biases, and this can lead to policy resistance.
4. Image has both emic and etic aspects for strategic planning; an overly emic perspective can be narrow and self-limiting, there must also be a willingness to accept an outsider's etic perspective.

As indicated by the results of the pre- and post-intervention questionnaire, all participants changed at least three responses to the 13 questions posed after viewing the model (Figure 22).

Questionnaire Responses 1 = Not important; 5 = Extremely important; ? = Unsure or Don't Know													
	Letter Per Year	Code or Date	In Progress	Should be Implemented	Implementation	Water for	Domestic	Recreation	Imp. of Time	Imp. of the Safety	Understanding	Imp. of the Safety	What does it do
	Apr. 2017	Mar. 2017	Jul. 2017	Aug. 2017	Aug. 2017	Aug. 2017	Aug. 2017	Aug. 2017	Aug. 2017	Aug. 2017	Aug. 2017	Aug. 2017	Aug. 2017
Chris Brown													
Domestic	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	?	?	(3)
Domestic Post	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Domestic	3	3	3	Domestic Security	Water availability	?	Domestic	3	0-100 yrs.	3	Good	3	(3)
Domestic Post	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Good	3	(3) (Post-Intervention)
Domestic	3	3	3	Domestic Security	Water availability	?	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Domestic Post	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Ken Post (Chris Brown)													
Domestic	3	3	3	Domestic Security	Water availability	3	?	3	0-100 yrs.	3	Very Good	3	Future Planning
Domestic Post	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Domestic	3	3	3	Domestic Security	Water availability	?	Domestic	3	0-100 yrs.	3	Good	3	(3)
Domestic Post	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Domestic	3	3	3	Domestic Security	Water availability	?	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Domestic Post	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Ken Post (Chris Brown)													
Domestic	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Good	3	(3)
Domestic Post	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Domestic	3	3	3	Domestic Security	Water availability	?	Domestic	3	0-100 yrs.	3	Good	3	(3)
Domestic Post	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Domestic	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Domestic Post	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Peggy													
Domestic	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Very Good	3	(3)
Domestic Post	3	3	3	Domestic Security	Water availability	3	Domestic	3	0-100 yrs.	3	Very Good	3	(3)

Ranking of Systems 1 = Highest Rank; 5 = Lowest Rank					
	Domestic Security	Domestic Security	Domestic Security	Domestic Security	Domestic Security
Chris Brown					
Domestic	3	3	3	3	3
Domestic Post	3	3	3	3	3
Domestic	3	3	3	3	3
Domestic Post	3	3	3	3	3
Domestic	3	3	3	3	3
Domestic Post	3	3	3	3	3
Ken Post (Chris Brown)					
Domestic	3	3	3	3	3
Domestic Post	3	3	3	3	3
Domestic	3	3	3	3	3
Domestic Post	3	3	3	3	3
Domestic	3	3	3	3	3
Domestic Post	3	3	3	3	3
Peggy					
Domestic	3	3	3	3	3
Domestic Post	3	3	3	3	3

Figure 22. Pre-intervention and Post-intervention (Highlighted) Responses to Questionnaire

After exposure to the system dynamics model, four participants changed their Time Horizon to achieve significant job growth (two of these significantly changed from 1–5 years to 16–20 years, and 1–5 years to 11–15 years respectively) and all but one participant cited access to ag tech as having the greatest impact of the five modules on long-term growth versus only three who selected that response in the pre-intervention Questionnaire. Eight of the nine participants selected Extremely Important as the Impact Modeling had on Prioritization in their post-intervention Questionnaire versus three before seeing the model, eight participants selected Very Good as their Understanding of Feedback in the post-intervention Questionnaire versus only three beforehand (the ninth participant showed an improvement from his previous response). Additionally, every participant changed their Ranking of Systems importance as a result of running the model. There was no discernible pattern, however, that distinguished one Group from another in the responses, and the Questionnaire was of only limited value in assessing the impact of the system dynamics model on the participants' approach to regional strategic planning. The post-intervention interviews, then, proved in this case, to be the best qualitative method for evaluating that impact.

The three Areas of Impact that emerged from the post-intervention interviews discussed in the preceding section had a clear linkage to the four themes that had emerged in the pre-intervention interviews. While the system dynamics model provided the means to amplify the advantages of the collaborative planning process by adding clarity, increased systemic understanding and a degree of validation for the strategy, the limitations were diminished by providing a decision tool to better prioritize objectives in the absence of a single, adjudicating leader, and to increase alignment through a shared understanding that would reduce motivational biases between Groups. When considering individual mental models, the system dynamics model provided a greater understanding of dynamic complexity and structure/behavior relationships that were sometimes misunderstood and in most cases changed perceived time horizons for successful achievement of the strategy's objectives as well as the means to overcome policy resistance. Both the emic and etic aspects of the City's image were enhanced by the system dynamics model through a greater understanding of the interrelationships of



systems (dynamic complexity, structure/behavior relationships, and short-term fixes that lead to policy resistance). A summary of the effect the Areas of Impact had on the four Themes is captured in Figure 23.

		<b>Themes</b>			
<b>Areas of Impact</b>		<b>1. Collaborative Planning Advantages</b>	<b>2. Collaborative Planning Limitations</b>	<b>3. Mental Models, Biases</b>	<b>4. Image Perspectives</b>
	<b>General Insights Gained</b>	Clarity in terms of dynamic complexity; Understanding of structure/behavior relationships; general strategy. Validated/reinforced	Provided for alignment through systemic understanding of complexity; Reduced cognitive and judgmental biases; Provided objective tool for collaborative prioritization	Validated/reinforced some theories, Reduced biases by increasing understanding of dynamic complexity, structure/behavior relationships, policy resistance, & time horizon	Improved understanding of dynamic complexity, structure/behavior relationships. Attractiveness to outsiders is determined by a number of weighted factors, some can be controlled
	<b>Specific Insights into Sub-systems &amp; Modules</b>	Increased priority of Water; appreciation of Education impact on Start-ups, Attractiveness and Gang Membership	More emphasis on social benefit (education, gangs), Research; less focus on Start-Up Investment	Increased awareness of Ag Tech & value of Labor Pool; Increased understanding of Water and Education on Attractiveness	Education vs Gang Membership impact on Attractiveness; Gang membership and Attractiveness are result of system feedback
	<b>Potential Applications for Model</b>	Information & marketing for greater outreach, understanding	Decision tool for prioritizing; Information tool for better aligning Groups, diminishing cognitive biases	Decision tool for prioritizing; Information tool for better aligning Groups, diminishing cognitive biases	Information tool for greater community outreach; Decision tool for resource managers; Marketing for investment

Figure 23. System Dynamics Model Impact on Themes

In this section, I will summarize findings related to each of the four themes by relating my own analysis to previous research cited in the Literature Review in order to develop a grounded theory of the impact of system dynamics modeling on the development of regional strategy.

**1. There Are Advantages in Assembling a Diverse Strategic Planning Team and Employing a “Conversational” (Or Democratic) Approach to Collaboration**

In their study of the impact of broad cross-sector coordination on large-scale social change, Kania and Kramer (2011) found that, “substantially greater progress could be made in alleviating many of our most serious and complex social problems if non-profits, governments, businesses, and the public were brought together around a common agenda to create collective impact” (p. 38). Their research indicated that “Collective impact requires all participants to have a shared vision for change, one that includes a common understanding of the problem and a joint approach to solving it through agreed upon actions” (p. 39).

As discussed previously, one advantage of having diversity among the Executive Committee members in the planning process was that members of the Civic Group, the Non-profit Group, and the Private Sector Group shared a common understanding of the problem and the vision needed to address it. A second advantage was that the cross sectional coordination aspect of the process provided for the development of a broad range of shared objectives.

Strategic planning literature often cites the need for a disciplined or explicit approach to identifying long range goals and objectives (Armstrong, 1982; Bryson, 1988; Stacey, 1995.). Mintzberg (1994) understood that dense hierarchies can stifle innovation. An advantage of the collaborative and democratic approach taken by the Executive Committee was that it encouraged freedom of thought. The planning process was described as “conversational” in nature, representing a democratic or consensus approach.

When considering regional clusters, Bresnahan and Gambardella (2004) attempted to look beyond a recipe approach to cluster development to gain a deeper understanding of long term, sustainable growth. While they recognized that the measurement of growth was typically through the number of entrepreneurial start-ups, it took years to develop the conditions for sustained success. Further, their research explored external and internal effects, competitive advantage, government policy,

innovation, and collaboration among competitive companies. Of particular note was their finding that “The long term investment in education of a skilled labor force has been critical in a number of regions.” (p. 336). The advantage of the diverse interests represented in the Executive Committee was that it resulted in strategic objectives for the Cluster that spanned a much wider range of issues than would have been developed by a more homogenous composition of planning team members.

Post-intervention interviews illustrated several insights gained from participants that could contribute to the advantages of the collaborative approach. These insights included a better appreciation of dynamic complexity within the systems of the strategy, an enhanced understanding of feedback and behavioral relationships among these systems, and recognition that to avoid policy resistance, successful implementation of the strategy and effective prioritization of objectives required a shared systemic understanding.

## **2. There Are Inherent Limitations When Collaborative Strategic Planning Is Undertaken by a Diverse, Cross Sectoral Team**

This same diversity of membership cited above, resulted in two limitations. One limitation was that cognitive biases among individual Executive Committee members associated with the three Groups—Civic, Non-Profit, and Private Sector—led to differences of opinion regarding the motivation and approach taken in implementing the strategy that generated misalignment of priorities. For example, members of the Non-Profit Group perceived a shift in focus to the importance of entrepreneurial start-ups over time, at the expense of other objectives, specifically developing an educated and adaptable labor force through education. A second limitation was that the lack of an identified adjudicating leader hampered the Committee’s ability to effectively prioritize objectives. These findings are consistent with previous research that found discontinuities among governmental, commercial, and non-profit groups striving to solve large problems (Kania & Kramer, 2011; Rouwette, et al, 2002).

Kania and Kramer (2011) found that alignment was a challenge for organizations with diverse membership that were attempting to address large scale social change in

complex systems. While the diversity of the Committee's membership contributed to creative thought and broadened the scope of the strategy, sweeping in issues of social benefit, education, and quality of life, it allowed space for conflict based on differing motivations and cognitive biases. Whittington (1996) argued that effective strategists must draw upon actual practice. A limitation of the Steinbeck Innovation Cluster planning approach was in not leveraging the practical, managerial skills of a key leader. The lack of a single leader, then, mitigated against a more disciplined approach to prioritization and diminished the Committee's ability to effectively prioritize the objectives and initiatives upon which the members had agreed.

In their study of radical versus continuous change in an organization, Plowman et al (2007) describe complex systems as being "characterized by nonlinearity as their components interact with one another via feedback loops (Anderson, 1999; Chiles et al, 2004; Cilliers, 2000; McKelvey, 2001)" (p. 519). Further, they found that, "emergence occurs in the same pattern across stages or levels in an organization" (p. 521). The Executive Committee lacked an informed understanding of the feedback mechanisms at play within the systems addressed by the strategy and within the organization of the Committee itself. Sterman (2000) wrote, "System dynamics is a powerful method to gain useful insight into situations of dynamic complexity and policy resistance" (p. 39). Prior to exposure to the system dynamics model, the Executive Committee had no means to fully understand the complexity represented in the broad objectives they identified, nor a clear understanding of the impact short-term fixes would have over a longer time horizon.

Participants expressed the belief that the system dynamics model could not only diminish cognitive biases among the Groups, but could also reduce the need for a single leader by allowing the model to provide a consensus on prioritization objectives and a more systemic approach to investment thereby mitigating the identified limitations of a diverse, cross-sectoral team.

### **3. Mental Models and Perspectives Can Vary Greatly Among Planning Participants Based Upon Cognitive Biases, and This Can Lead to Policy Resistance**

As cited in the literature review, Schaffernicht and Groesser found, “Research has demonstrated that more comprehensive and dynamic mental models seem to be at the foundation for improved policies and decisions” (2011, p. 57). Doyle, Radzicki, and Trees (1998) believed that the purpose of employing system methodologies, including the use of system dynamics modelling and flight simulators is to enhance those mental models by making them more complete and complex. Sterman (2000) noted that system dynamics brings together many qualitative as well as quantitative disciplines, including cognitive and social psychology and economics. One would assume that this applies as much to decision makers using them as it does to the systems being modeled. While it was not my intention to determine in detail what each participant believed to be their mental model of the Steinbeck Innovation Cluster strategy, the coding and analysis of pre-intervention interviews, observations, and Questionnaire responses did provide some insight. The individual mental models of the participants incorporated inevitable cognitive biases related to differences in perspectives on profit versus social benefit.

Barnes (1983) identified several judgmental biases that may obscure the objectivity of decision and policy makers including overdependence bias, representativeness bias, hindsight bias, and availability bias. Many of these biases were evident in the pre-intervention interviews and Questionnaire response covered in the last section. Kurtz and Snowden (2003) found that decision makers and policy advisors fit reality into their existing mental models. This is a primary source of policy resistance, as identified by Meadows (1999), and results in short term fixes that only exacerbate systemic problems over time. Each participant expressed their own theory of economic development and the time horizons they anticipated would be required to achieve results based, in many cases, on judgmental biases used to determine these.

In his study of strategic planning among major oil companies, Grant (2003) found an evolution over time that resulted from an increasingly uncertain and turbulent economic and political environment. This trend incorporated complexity theory in

shifting from an approach of strategy as design, to strategy as process. Holmberg and Robert (2003) discussed the methodology of back-casting, determining the objective and working backwards to create the conditions to achieve it. Elements of a similar trend that focused on the democratic process of strategy development, as well as some back-casting in visualizing a desired outcome were apparent in the pre-intervention interviews. Bryson (1998) believed that decision makers generally seek structure, and that strategic planning requires discussions as well as decisions among the key players. The mental model of the Steinbeck Innovation Cluster planning process was originally accepted as being conversational to allow for freedom of thought. Many participants had a representativeness bias that, at least initially, led them to believe positive outcomes were inevitable. Over time, cognitive biases arose that challenged this optimism, and as has been seen, they perceived misalignment in priorities over time.

Each participant had a mental model of what the Steinbeck Innovation Cluster represented. Some participants viewed this in terms of systems, or eco-systems that would evolve naturally. Bresnahan and Gambardella (2004) found that starting a cluster and sustaining a cluster involved different dynamics. While starting a cluster depended on existing economic foundations of a particular industry, sustaining an innovation cluster required continuing investment to set the preconditions of success. Iammarino and McCann (2006) explored differences between old “social network type” clusters with a hierarchical structure that enabled innovation through a mix of cooperation and competition, and a “new social network” that depended on relational and cognitive proximity. They believed that areas of high competitiveness and high opportunity could drive innovators together in a regional cluster, but they also explained that the oligopolistic structure, characterized by a few large firms that divide major market share and are skeptical of sharing knowledge, could diminish competitive advantage. The theories of the participants reflected many aspects of this research, but again, their mental models were affected by judgmental and cognitive biases that led them to focus on one aspect of economic development or another and to underestimate the oligopolistic challenges of the agriculture industry they described.

Exposure to the system dynamics model provided a “grounding” for the Executive Committee members by increasing their understanding of the feedback mechanisms at play within and among the modules. This caused many participants to re-evaluate their understanding of cause and effect as well as some of their imagined outcomes. The system dynamics model further caused most participants to re-assess the time horizon and prioritization of objectives required to achieve desired results. Better understanding the complexity and structure/behavior relationships within the systems of the strategy provided clarity and a shared focus on longer term consequences that would aid in diminishing policy resistance going forward.

**4. Image Has Both Emic and Etic Aspects for Strategic Planning; an Overly Emic Perspective Can Be Narrow and Self-Limiting, There Must Also Be a Willingness to Accept an Outsider’s Etic Perspective**

As discussed in the preceding section, Executive Committee members from all three Groups, whether they resided in the local area or in Silicon Valley, recognized the impact the image of Salinas had on both outsiders and local residents. It was determined early in the strategic planning process that branding a new image of Salinas might increase its attractiveness to prospective residents and investors, and considerable outreach was conducted in the City and the County. This outreach included a spectrum of audiences and stakeholders from the public, private, and non-profit sectors.

As cited, Kania and Kramer (2011) explored the effort of organizations to solve social problems through collaborative effort. They found that successful collective impact must be supported by funder collaborations, public-private partnerships, multi-stakeholder initiatives, social sector network, and collective impact initiatives requiring long term commitments. Kania and Kramer recognized, “Developing trust among non-profits, corporations, and government agencies is a monumental challenge,” that calls for continuous communication (p. 39). They further recognized the need to develop a common vocabulary and a shared system of measurement. While the Executive Committee recognized a similar need for support and shaped communications for broad community outreach, this effort fell largely to individual members of the Executive Committee presenting the strategy from their own perspective. Jonas (2007) applied

structural complexity and practices in action in a study of emergence processes in regional clusters. In discussing the integration of artefacts in social practice, he found that normality at least partially consists of collective learning processes, and refers to “a common cluster specific language of specific knowledge about actual co-operation possibilities” (p. 5). Within the Executive Committee, there was a shared vision to create an agriculture technology cluster, but there was little common language or terminology used to convey this to various stakeholders.

The pioneering work of Strogatz and Watts, Granovetter and others was discussed in the Literature Review section on Systems, Complexity, Networks, and System Dynamics, and later, in the section on Industrial Clusters, it was noted by several of the researchers cited, that social networks and small world phenomena are often considered in studies of cluster emergence (Gordon and McCann, 2000; Porter, 2000). Iammarino and McCann (2006) identified three cluster types—agglomerations, industrial complex, and social network clusters—noting overlaps among these. Executive Committee members spoke of the importance of bringing different professional, academic, and social networks together for collaboration and to gain a broader foundation of support for the Steinbeck Innovation Cluster, but there was little emphasis placed on how best to achieve this, other than through the outreach mechanisms already discussed. While certain persons or institutions were mentioned as being key hubs or connectors of sorts, there was no clear vehicle offered in the pre-intervention interviews to bridge these hubs together. Iammarino and McCann further asserted that three key factors impacted geographic innovation: skills, ideas, technologies, and cultures; an environment that encouraged unconventional initiatives to be introduced into the marketplace; and, competitive arenas that provided for selection criteria to enhance the development of future markets (2006). While members of the Executive Committee concurred in their pre-intervention interviews that Salinas Valley had these characteristics of geographic innovation, there was no tool with which to market the synergy of these or to objectively evaluate the impact of one initiative or another in the very competitive local agriculture industry.



Post-intervention interviews indicated that the system dynamics model could be employed as both an informational/marketing tool and as a decision tool to align a variety of stakeholders and to connect the networks they represent by presenting a more positive image of Salinas and the Steinbeck Innovation Cluster. One interesting aspect of this was an apparent shift in focus from the negative image of gang violence to addressing the challenges of education that could contribute to area attractiveness while mitigating against gang membership through STEM inoculation programs and access to agriculture technology curricula in the public schools. Further, the use of the model as a decision tool was seen as the means to more objectively prioritize the application of resources and to evaluate the impact various initiatives would have on the long term effectiveness of the strategy. When used as both an informational/marketing tool and as a decision tool, Executive Committee members saw the system dynamics model providing the means to enhance the understanding of dynamic complexity and structure/behavior relationships community at play within the systems of the strategy for stakeholders and potential investors. The system dynamics model was also seen as the means to offset competitiveness and to encourage cooperation. Participants gained a better appreciation of the role research and education could play in developing the thick labor pool required to sustain new agriculture technology start-ups. Finally, participants believed the system dynamics model could be used in a collaborative environment to better align community leaders, in essence, to avoid short term thinking that could lead to policy resistance, particularly in the areas of water management, education, and gang membership.

#### **E. THE EMERGENCE OF A GROUNDED THEORY**

The objective of this research was to allow a grounded theory to emerge from the data collected that would address the impact of system thinking and system dynamics modeling on the development of a regional strategy. By coding and analyzing interviews, observations, and data collected during the case study, and comparing and contrasting existing research with my own, the following grounded theory emerged: System thinking and the use of small, system dynamics models can enhance the awareness of decision and policy makers by clarifying dynamic complexity and structure/behavior relationships, and

may contribute to collaborative, cross-sectional effort that diminishes the pitfalls of policy resistance in regional strategic planning. Specifically, small system dynamics models can:

- Help to dispel cognitive and judgmental biases within diverse, cross-sectoral planning teams
- Provide a decision tool for use during strategy development and implementation phases of strategic planning to help prioritize objectives and to possibly diminish the need for an identified, single leader with adjudicating authority in such teams
- Provide an information tool to broaden community support and to align cross-sectional collaboration within the planning team
- Provide a marketing tool to generate interest in investment and funding

It should be noted that the potential benefits of system dynamics modeling, in this case, did not come from the participants' direct involvement in building the models, the subject of much previous research (Ackermann et al, 2010; Rouwette et al, 2002; Rouwette et al, 2011; Snabe, 2007). Although concepts of system thinking were introduced during the strategic planning process, the Executive Committee members were not exposed to the model until 15 months after the planning process had been concluded. Even then, each participant clearly spoke of the clarity the model had provided and of the foreseen benefits of employing the model in taking the strategy forward.

## **VI. CONCLUSIONS, CONTRIBUTION, AND FUTURE RESEARCH**

The purpose of this action research case study was to qualitatively determine how system thinking and system dynamics modeling informed regional strategic planning and to derive a grounded theory based upon data collected during the Steinbeck Innovation Cluster strategic planning process. Three areas of previous research were investigated: Systems, Complexity, Networks and System Dynamics; Strategic Planning; and Industrial Clusters. The findings of this study were then compared to the work cited in the Literature Review to address perceived gaps in bringing these three disciplines together by developing a grounded theory on the potential value of applying system thinking and system dynamics modeling to regional strategic planning. The grounded theory that emerged is, System thinking and the use of small, system dynamics models can enhance the awareness of decision and policy makers by clarifying dynamic complexity and structure/behavior relationships, and may contribute to collaborative, cross-sectional effort that diminishes the pitfalls of policy resistance in regional strategic planning.

This study contributes to each of the three areas of research already mentioned and was intended to fill perceived gaps in merging network theory, system dynamics, and theories of sustainable cluster development with work that examines the evolution of strategic planning. Further, this study builds upon previous attempts to evaluate the impact of system dynamics modeling on mental models by qualitatively evaluating pre- and post-intervention responses of actual regional strategic planners from three organizational cross-sections that included the private sector, the non-profit sector, and the government or civic sector.

Another contribution of this research is that small system dynamics modules were integrated into a system of systems model used to simulate potential non-linear behavioral outcomes of a strategy that had not yet been implemented, overlaying this strategy on real-world civic structures. Since many of the modules were conjectural—based upon the strategy being simulated—validation of the model structure and initializing-data was provided by local subject matter experts versus a more traditional

comparison of modelling outputs to historic trends. This method of validation was not only accepted as valid by all participants, it was cited as being valuable in adding credibility to the model. The purpose of the model, it was made clear, was not to be predictive of point-data outcomes, but rather to enhance an understanding of feedback mechanisms within the systems being modeled and the behavioral trends they might produce over a 25-year time horizon. Three Areas of Impact described by the participants in post-intervention interviews were used to evaluate how the models had affected individual mental models and perspectives related to three themes that had emerged from pre-intervention interviews. Pre- and post-intervention Questionnaire responses contributed to this qualitative assessment and added to previous research heavily dependent on quantitative methodology.

Future research is needed to more fully assess, both quantitatively and qualitatively, the impact small system dynamics models have on collaborative strategic planning. This might include group assessments and survey research to better determine mental models both before and after exposure to the system dynamics modeling. Additional research might also attempt to explore the modeling of social and professional networks that play a role in the emergence and sustainability of regional clusters. Longitudinal data could be used to revisit initial modelling assumptions as a strategy enters the implementation phase, comparing the efficacy of the strategy over time to historic trends.

During post-intervention interviews, it was evident that each participant found meaning in the model, but they tended to focus on areas of particular personal interest. The former mayor, Dennis Donohue focused on the concept of STEM inoculation to reduce gang violence. After seeing the model, Erin Fogg, who had previously been very focused on the need to address gang violence, recognized gang violence was an indirect effect of other factors that could be addressed directly (such as education and job creation). John Hartnett had been very focused on entrepreneurial aspects of profit before seeing the model, but was personally inspired by the idea that investment in education and start-ups could have a direct impact on reducing gang violence and improving the lives of community members. It should be noted, that in the year and a half since the

strategy was publicly announced, divisions had arisen among the planning team regarding steps necessary for implementation, largely along Group lines that have been identified. However, each participant had a renewed sense of purpose after experiencing the model-run and a desire to move forward again as a group. What's interesting from a social science perspective is that even though all participants felt a common sense of purpose, they did not necessarily agree on what was most meaningful in the model outcomes. This implies that cross-sectoral, multi-party collaboration does not require full agreement on the meaning of an object that facilitates cooperation.

There is a body of research that addresses this phenomenon. In a study of the collaboration among amateur scientists, professionals, and administrators related to the Museum of Vertebrate Zoology at the University of California, Berkeley, Star and Griesemer (1989) found that consensus among disparate players isn't necessary for cooperation, but that methods standardization and the development of boundary objects could contribute to a collaborative experience. What is of most interest here, is that boundary objects are described by the authors as being concrete or abstract, but "plastic enough to adapt to local needs" of the participants employing them, and "robust enough to maintain a common identity" (p. 393). This suggests that knowledge representation through systems modeling might be a powerful means to generate alignment, not because it inspires groups to agree, but because it is a minimal structure that stimulates just enough agreement to offset conflicting interpretations of what the object means for each stakeholder group. Under conditions of multi-party dialog among stakeholders with different priorities and with differing interpretations about desired futures, simulations might then serve as boundary objects that facilitate cooperation for committing to future action. Further research in this area is needed.

Boundary organizations is an area of study related to cross-sectoral collaboration through boundary management and boundary objects that was addressed by O'Mahony and Bechky (2008). The authors explored four community projects that challenged proponents of proprietary software development to achieve common goals through open source collaboration. The balance that was sought in each case was the advancement of social movements with commercial interests that traditionally obstructed their progress.

This research focused on the use of boundary management strategies to promote convergent interests that could off-set divergent interests through collaboration. The authors asserted that boundary organizations, comprised of members from diverse and apparently opposing communities, could provide a mechanism to accommodate the convergent interests of its members while allowing divergent views to persist. O'Mahony and Bechky described boundary organizations that represented collaboration among firms, specific software projects, and non-profit foundations. Organizing practices among the stakeholders worked across four domains—governance, membership, ownership, and control over production—that allowed the parties involved to adapt and collaborate without sacrificing divergent interests. Three characteristics are cited by the authors that distinguish boundary organizations from other approaches to collaboration: adaptations around organizing domains, delineation of interests, and durability of organizational structure. Within this context, the Steinbeck Innovation Cluster executive committee described in my research can be seen as a boundary organization that leveraged the system dynamics model as a boundary object to align converging interests with the divergent perspective and interests of the three Groups identified. The manner in which boundary organizations are formed and the means to develop collaboration among diverse members of these organizations is an area for future research. One aspect of this could involve the application of design thinking.

Buchanan (1992) explored collaborative design thinking in the context of wicked problems. The author explains that wicked problems are loosely defined by their indeterminacy that implies no clear limits to design problems as compared to determinant problems with well-defined design conditions. In essence, when confronted by complex problems there is a distinction made here between traditional, linear approaches to design thinking and wicked, or non-linear, approaches. Communication among diverse stakeholders in a boundary organization might benefit from a design thinking methodology that accepts the “wicked” nature of complex problems and design solutions. As discussed, the system dynamics model employed in my research provided participants insights into the non-linear complexity of interrelationships within the strategy and the means to better align their prioritization and discussions based upon a

common understanding of the problem set. Further research is needed to explore the application of design thinking in the context of boundary organizations and boundary objects as well as in the collaborative development of system dynamics models.

Another area of research closely related to my findings is described by Boland and Tenkasi (1993) as perspective making and perspective taking in communities of knowledge. The authors assert that knowledge work is “typified by high task variability, uncertainty, and competing, multiple goals” within organizations (pp. 3–4), and they use an open system, cybernetic model to explore feedback control mechanisms that impact communications among communities of knowing. In this context, perspective making represents the process of knowledge sharing that relies heavily on personal and shared narratives to enhance sense making. Perspective taking involves the presentation of diverse knowledge brought to the organization by individuals and making that unique knowledge available to others within the organization. The authors acknowledge that judgmental processes come into play on an individual level and the personal heuristics they apply often include cognitive biases, such as availability bias, that can lead to an over estimation that their personal perspectives will be shared by others. The integration of knowledge among knowing communities then depends on both individual and group perspective making as well as the means to share knowledge for inter-community perspective taking. The authors go on to suggest that electronic communications may provide one means of supporting the diverse interests of separate communities of knowing. This line of reasoning would seem to beg the question, can the concept of using system dynamics models as boundary objects also serve as a tool for expressing a shared narrative to enhance perspective taking and perspective making. As was expressed by the participants in my research, the system dynamics model provided them a sense of cross-sectoral, shared understanding and the ability to then market their strategy to others by providing a more concise vision of the way ahead. In fact, each participant was eager to share the model with others to enhance their understanding of feedback mechanisms at play within the strategy. Further research is required to measure the impact of system dynamics modeling on perspective taking and perspective making.

One of the more interesting aspects of my research was the impact system dynamics modeling had on four of the participants' mental models of the time required to achieve significant results from the strategy's implementation with two participants significantly extending their initial time projections. And while all participants recognized the value of using a 25 year time horizon for the model run, none seemed deterred or overly concerned that progress in some areas—particularly the time required to improve the standard of education, the development of a sufficiently thick skilled labor force, or a significant increase in new business start-ups—might be longer than originally anticipated or desired. Further, the fact that water constraints became a significant constraint to economic growth in the out-years only seemed to imbue them with a sense of urgency in addressing this through near term pursuit of solutions such as increasing the amount of water available through desalination and reclamation. In an interesting study of adolescent high school students, de Bilde, Vansteenkiste, and Lens (2011) found significant correlations between extended future time perspective and school work. Those students with an extended future time perspective generally attached more value to their school work than those students who lacked this. While there is no clear mapping of this study to future time perspectives of adults engaged in strategic planning, there does seem to be a suggestion that individuals with an extended future time perspective could be better suited to a more rigorous effort in planning and executing tasks over a long time horizon. Could using system dynamics modeling to simulate conjectural strategic plans over long time horizons provide the means to extend the future time horizon of strategic planners? This remains another area of future research.

Finally, it is recommended that future research explore the early introduction of modeling and system thinking in the strategic planning process to evaluate insights gained and incorporated into strategies as they are being developed and modified over time and the unquestioned acceptance of data in offsetting cognitive biases.



## **APPENDIX A. CHRONOLOGICAL NARRATIVE**

This Case Study is focused on the strategic planning process employed by the Steinbeck Innovation Executive Committee that primarily covered the period of time from April 2012 through December 2012. While the work of the Steinbeck Innovation Executive Committee was formalized under the Steinbeck Regional Innovation Foundation (a 501c3) in December 2012, and continues today, emphasis shifted to the implementation of the strategy in January 2013. Therefore, although elements of the implementation of the strategic plan will be discussed in this Case Study, it is the strategic planning process that began in April 2012 and was largely concluded by December 2012 that is the focus.

### **Initial Discussions**

In September 2011 I was assigned to the Naval Postgraduate School (NPS) faculty as Chair for Systemic Strategy and Complexity by Secretary of Defense Leon Panetta, after serving three years as a Special Assistant for Strategy on the Personal Staff of Admiral (ADM) Michael Mullen, Chairman of the Joint Chiefs of Staff. My mandate at NPS was to explore the application of system science to strategic planning and to conduct outreach across civic, private, and academic institutions. While serving on ADM Mullen's staff, I had co-written with Marine Colonel Mark Mykleby, a document entitled, "A National Strategic Narrative" that was subsequently published online by the Woodrow Wilson Center for International Scholars, with a forward provided by former Director of Plans and Policy at the US State Department, Dr Anne-Marie Slaughter (Porter & Mykleby, 2011). That document, intended to frame a positive understanding of America's role in the complex and uncertain strategic environment of the 21<sup>st</sup> Century, had, by late 2011, been widely cited and garnered a good deal of interest on the worldwide web.

My association with Dennis Donohue, then Mayor of Salinas, California began with a chance meeting at a winter reception at NPS in December, 2011. Having been introduced to the mayor by the provost as a "strategist," a conversation ensued regarding

the Mayor's desire to develop a strategy for economic development in Salinas that could leverage the technological and innovation advantages of nearby Silicon Valley. We briefly exchanged thoughts on the application of IT technology in agriculture, an area I concurred would be a future focus of innovation and capital investment. As a result of that conversation, Mayor Donohue invited me to visit him in his office and to discuss such a strategy in more detail.

A few weeks later, in January 2012, I met with Mayor Donohue in his office in Salinas, and he recounted for me the challenges he, and the city, were encountering. Salinas, the birthplace of Nobel and Pulitzer Prize winning author John Steinbeck, had been a thriving center of agriculture and ranching in the 1920s. While continuing to be the recognized epicenter of America's "Salad Bowl"—due to the powerful row-crop and grape industry in the region—Salinas itself was an aging, rural, middle sized city (population approximately 150,000) with a largely shuttered downtown business district, beset with major gang violence, a moribund economy, and heavily migrant population centered on farm labor. The Mayor explained that many of the city's youth were first generation Americans born of immigrant parents from Mexico, and so were living in a bilingual environment with significant cultural and educational challenges. Water constraints limited commercial, agricultural and residential growth, and the predominantly young, Hispanic population was being victimized by gang influences and the lack of employment opportunities. Gang violence had created a stigma that discouraged new business development or outside investment. And, he noted, all of this was occurring just 20 miles from the wealth of the Monterey Peninsula, within reach of several renowned institutions of higher learning, and 60 miles from the largest engine of new business development and technology innovation in the nation, the Silicon Valley.

In our meeting, I explained that my role on the Joint Staff was to provide ADM Mullen a broader systemic understanding of national and global issues that affected U.S. defense policy. My framing of this situational awareness was often provided in terms of an "opportunity space" as opposed to focusing solely on anticipated risks and threats: positively influencing global trends, rather than reacting to their manifestations in specific geographic locations. During my tenure on the Joint Staff, I provided a classified

weekly assessment of opportunities we could seize as a nation to advance our enduring national interests of prosperity and security. From a regional perspective therefore, I told the Mayor that what he was identifying as *challenges*, I saw as *opportunities*. My initial assessment was that the demographics, economic focus (agriculture and aquaculture), water management constraints, gang activity, immigration issues, environmental concerns (largely related to agricultural nutrient runoff), and flagging service-based development provided an opportunity to demonstrate a new model of *community* prosperity and security. My contention, based upon research I was conducting into successful industrial clusters, was that the Salinas Valley and neighboring Silicon Valley could foster a cooperative effort to reinvigorate a manufacturing base focused on precision agriculture by leveraging the power of university research and the potential inherent in the area's young population. I opined that regional education could be tailored to support this partnership while at the same time providing employment opportunities and hope to offset the malign influence of gang recruitment and violence. Mayor Donohue concurred that what was needed was a strategy of opportunity. Mayor Donohue suggested that we have a follow-up meeting with Mr Lon Hatamiya, former Secretary of the California Technology, Trade and Commerce Agency, whose company had recently done an economic development study for the City of Salinas. A week after my initial visit to City Hall, I met with Mr Hatamiya and Mayor Donohue, again in the Mayor's office.

During the meeting with Lon Hatamiya and Mayor Donohue, we discussed the challenges and opportunities inherent in Salinas and the agriculture community of central coast California. We discussed public education and the demographics of the area (75 percent of the population of Salinas is Hispanic), the cultural and economic ties between Californian and Mexican agriculture industries, gang activity and its negative impact on local businesses and potential investment, and the need to stimulate job growth. The Mayor mentioned the local Mexican diaspora and contrasts/possible synergies with the Irish diaspora involved in the technological boom in the Silicon Valley, as well as the common interests in agriculture among the United States, Mexico, and Ireland—what Mayor Donohue hoped to sell as the “world's first fresh highway.” We also spoke of the opportunities that combining the IT industry with agriculture might offer many returning

US Veterans who possessed necessary skill sets and a work ethic that could provide mentorship to the youth of Salinas. And we discussed the importance of recognizing renewable resources as a central focus of a strategy of growth in the region, specifically energy, soil, and water. Mayor Donohue cited the Irish Technology Leadership Group (a Silicon Valley-based NGO) as a critical link in connecting the agriculture sector in Salinas to the innovation and technology center of Silicon Valley. Mr Hatamiya also mentioned the Agriculture Innovation Center at University of California, Davis as a resource. I suggested that the Mayor consider the establishment of a Renewable Resources Industrial Commons that could leverage technology innovation with a focus on sustainable agriculture, energy, and water. We agreed to think about a comprehensive approach to economic revitalization for Salinas.

Mayor Donohue and I exchanged several e-mails over the next two weeks and his enthusiasm for the concept of a Renewable Resources Industrial Commons was clear. He mentioned that he was working with someone at the Irish Technology Leadership Group to help develop an “innovation/investment strategy.” On 31 January 2012 he sent me an email stating, “*The renewable Resource Commons is the big idea!*” In early February I was invited to join the Mayor in a meeting with representatives from the University of California Research and Extension Center System that was being hosted by Norm Groot, Executive Director, Monterey County Farm Bureau, at the Grower-Shipper Association of Central California in Salinas. Mayor Donohue asked whether I could provide him some notes for that meeting that described my concept for a Renewable Resources Commons.

On 10 February 2012 I provided the Mayor the following comments in an e-mail:

Throughout the world, there exist global industrial commons that draw the best innovators in science, technology and production to geographic nexus of commercial, academic, and labor interests. Salinas and the Central Valley are ideally positioned to demonstrate the efficacy of a new systemic strategy based on sustainability. By establishing a holistic model based on education, research and development, and practical production applications, Central California (centered in Salinas) could become the world’s global industrial commons for Renewable Resources—energy, water management, agriculture and the food supply chain... Capital investment (both domestic and foreign) would contribute to academic and

commercial research and development with contributors coming from Silicon Valley, the Bay area and the Central Valley itself. .. This all begins with education and the development of leading edge innovation and a skilled labor pool. (Porter, e-mail, October 2, 2012)

At the meeting later that morning, both Mayor Donohue and I had a chance to discuss the concept of the Renewable Resources Industrial Commons, and I was introduced to the President of Hartnell College, Dr Phoebe Helm. She was quite interested in the role education could play in this concept. A few days later, I sent Mayor Donohue and Dr Helm a “conceptual drawing” (Figure 1) of what such a Renewable Resources Industrial Commons might look like, and Mr Hatamiya sent me a draft of the “Salinas Economic Development Strategy 2011” his company had prepared for the City of Salinas (Hatamiya, 2011).

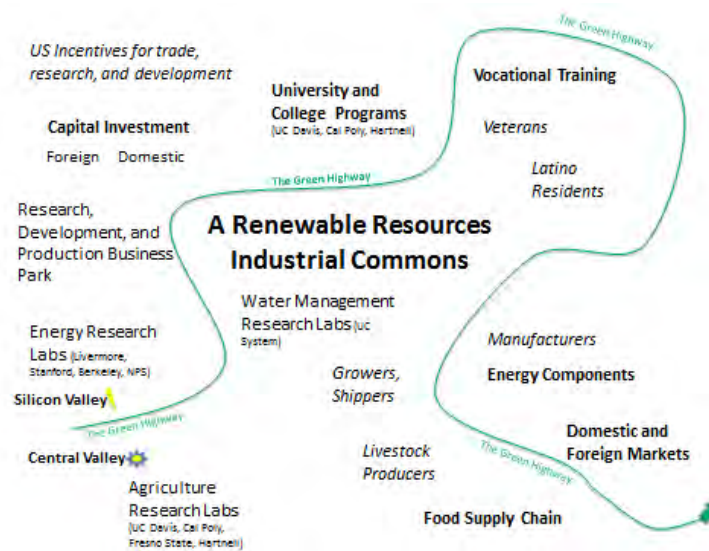


Figure 1 Concept Drawing for A Renewable Resources Industrial Cluster

Over the next several weeks, I drafted a paper entitled, “Engineering American Industrial Commons” suggesting that it might be possible to “engineer” industrial commons focused on sustainable agriculture and alternative energy in the Salinas and Central Coast California region and on sustainable aquaculture and alternative energy in the Gulf of Maine (Porter, 2012). In that article, I cited the work of Gary Pisano and Willie Shih at Harvard University, who had published in 2009 an article in the Harvard

Business Review, entitled, “Restoring American Competitiveness” (Shih & Pisano, 2009). Although my paper was never published, it did eventually provide a coalescing strategic vision for Mayor Donohue and the team of stakeholders he would assemble in the months ahead.

In late January 2012, Mayor Donohue publicly announced that he had decided, for personal reasons, not to seek reelection as Mayor of Salinas, but would continue to serve the rest of his term due to expire in December, 2012. Privately, he assured me he would continue to pursue an economic development strategy for the City and, as a commercial radicchio grower, he would remain a “point person” for linking the Grower-Shipper Association to this strategy. After reading my draft article, “Engineering American Industrial Commons,” Mayor Donohue increasingly seemed interested in integrating work he had done with Dr Hy Rosthein at Naval Postgraduate School in countering gang influence, and on bringing local education opportunities to bear through a partnership with Hartnell College. In an e-mail, he commented, that, *“This scenario also speaks to the ‘complete win’ concept Hy Rosthein developed that Salinas is working on. The Industrial Commons is also a transitional model that leads Salinas to a local complete win. I think a see a real ‘opening’ to tie everybody’s work together”* (Donohue, e-mail, March 12, 2012). In the middle of April, Mayor Donohue invited me to a meeting with Mr Matt Yearling from the Irish Technology Leadership Group to discuss a possible link between Silicon Valley business interests and Salinas. He provided Mr Yearling my draft article as a “read ahead.”

On 16 April 2012, Mayor Donohue convened a meeting at Salinas City Hall for Mr Yearling and some key stakeholders interested in the Mayor’s strategic vision to link Silicon Valley technology and innovation with the City of Salinas—what he referred to as “networked agriculture and technology.” City representatives were present to speak of solid waste management, water management, and agriculture. I contributed comments on the importance of sustainability that could be achieved through the integration of economy, agriculture, water management, renewable energy, and livestock management. Mr Yearling said that the Irish Technology Leadership Group (ITLG), led by its founder, John Hartnett, could help bring together talent, customers, and capital investment in

technology and innovation. He cited work that had been done by the ITLG in Ireland. He opined that talent and imagination are increasingly virtual, but there need to be anchors in manufacturing, production, agriculture, etc. He posed the question, “What does the network consist of?” I suggested that the focus should not fail to recognize the systemic nature of the environment—renewable resources—including education and area youth. Patrick Matthews from the Salinas Solid Waste Authority discussed solid waste recovery as an example of a resource that could be better advantaged for profit and ecological benefit.

### **The Closing of HSBC and the Establishment of the Steinbeck Innovation Team**

On May 12, 2012, the *Monterey Herald* newspaper printed an article, written by Kate Moser entitled, “Capital One to lay off 850 Employees in Salinas” that announced that Capital One, which had recently acquired the HSBC office in Salinas, was planning to lay-off 850 employees by the middle of 2013. Mayor Donohue forwarded me the article and commented, “*This announcement is a major blow to Salinas*” (Donohue, e-mail, May 3, 21012). This single event would have a profound impact on the City of Salinas and proved to be a forcing function in the establishment of a strategic planning effort spearheaded by the Mayor. On May 16, 2012 Mayor Donohue convened a meeting at City Hall with John Hartnett, founder of the ITLG, Salinas City Manager, Ray Corpuz, Director of the Salinas Community and Economic Development Department, Jeff Weir, local banking and wine industry executive LuAnn Meador, NPS National Security Affairs Professor Rodrigo Nieto-Gomez, and a small group of community leaders. Mayor Donohue had informally asked John Hartnett to take the lead on developing an economic recovery plan for the City, following the news of the impending Capital One office closure. An informal “Steinbeck Innovation Team” began to emerge among key community stakeholders and a small Executive Committee evolved from that larger group.

Following that meeting, John Hartnett sent an e-mail to the participants with my paper, “Engineering American Industrial Commons Revised Version” as an attachment (Porter, 2012). In his e-mail, Mr Hartnett stated, “*We have a strong Agricultural heritage*

*& strength and combined with innovation we can create future opportunities for our community...Salinas is well positioned to be the hub that deals with the challenges of food security, Water management and access to adequate sources of energy (See Captain Porters doc attached.)*” (J. Hartnett, e-mail, May 18, 2012). The notion of “community,” “hubs,” “agriculture,” and “innovation” were early considerations in his strategic thinking. This e-mail would serve as the foundation and launching point for all future strategic planning described in this Case Study and illustrates that much of the strategic planning process was conducted via e-mail exchanges among Executive Committee members, with actual meetings used to discuss and validate the emerging strategy.

On May 30, 2012 another meeting of the plenary Steinbeck Innovation Team was convened at City Hall. The minutes from that meeting covered structure and team composition; the value proposition; development of strategy, objectives and game plan; communications; measurement (tracking performance); and, strengths, weaknesses, opportunities, threats (SWOT) analysis. As part of this SWOT analysis, it was decided to add research, tourism, and local investment potential as strengths, automation of agriculture as an opportunity, and negative press (primarily from gang-related violence) as a threat. Finally, the team agreed to establish the top three priority activities for the first 100 days and to establish the top three priority activities for long-term goals. On June 13, 2012 the next meeting of the “Steinbeck Innovation Team” (as it had come to be called) was convened in Salinas City Hall. Hartnett led a discussion of the City’s Strengths, Weaknesses, Opportunities, and Threats, based on the SWOT list that he had developed in an earlier meeting:

Need to work to develop education as a strength but that will take longer than 90 days.

Quality of Life is a strength.

Young workforce is a strength but skill sets and opportunities need to be developed.

Negative Headlines are a weakness. (J. Hartnett, Meeting Minutes, June 13, 2012)

There was increasing awareness among the group that there needed to be both near-term (90 days) and long-term planning that would not only address the immediate



concern of the impending CapOne lay-off and its perceived impact on the community, but would generate a strategy for lasting economic development.

### **Coderdojo and Early Strategic Thinking**

John Hartnett had become very interested in a program called “CoderDojo” that had been developed in Dublin, Ireland by a 19 year old Irishman named, John Whelton. The concept was that experienced computer programmers donate their time to introduce kids (8–13 years of age) to computer program code-writing for gaming applications, websites, etc. The objective was to get kids interested not only in computer programming but in science and technology in general, and to do so in a fun and sociable manner. CoderDojos had subsequently been launched all over the world, including in Silicon Valley and Los Angeles, and Hartnett thought this would be a great forum to offer at-risk youth a safe and positive diversion in areas of heavy gang influence. I suggested that this might be linked to the development of a Magnet Middle School focused on high-tech agriculture and green technologies. These community initiatives led to a discussion of the need for the positive “branding” of Salinas:

We need to do a better job of branding ourselves. Negative media attention provides a negative view of the area locally. Need to decide what three things we first want people to think of when they think of our region. In order to have credibility, we need to focus on our real strengths. We need to come up with a “values statement” indicating what we are proud of as a community and why. (J. Hartnett, Meeting Minutes, June 13, 2012)

Finally, mentioned for the first time, was the need to establish a 501c3 foundation to formalize the planning and execution of an economic development strategy. It was in the course of that meeting that I suggested the effort might eventually benefit from the application of system dynamics modeling.

A few days later, John Hartnett followed up with a more detailed account of the Coder Dojo initiative:

CoderDojo is a movement orientated around running free not-for-profit coding clubs for young people. At a CoderDojo, young people learn how to code, develop websites, apps, programs, games and more. Dojos are set up, run by and taught by volunteers. CoderDojo makes development and

learning to code a fun, sociable, kick ass experience. It has just one rule: ‘Above All: Be Cool.’ <http://coderdojo.com/about-us/> is the link for more info.

So....after all that intro, Let’s do this in Salinas next month. (J. Hartnett, e-mail, June 18, 2012)

On July 9, 2012 the Steinbeck Innovation Team met again to discuss the way forward with Cap One. Hartnett discussed the establishment of a “Steinbeck Innovation Village” that could serve as an incubation center for new business Start-ups and to attract local businesses—as well as major U.S. and Silicon Valley-based corporations—to the area. A schedule of meetings (weekly) was planned and projected out over six months.

On July 20, 2012 a meeting of the Steinbeck Innovation Team was held in a conference room of the City Manager in Salinas. Attendees included what had now come to be called the Executive Committee—Mayor Donohue, City Manager Ray Corpuz, Director of the Salinas Community and Economic Development Department Jeff Weir, City Council member Sergio Sanchez, and John Hartnett—as well as other Team Members, LuAnn Meador, Kurt Gollnick of Scheid Wintery, Monterey County Farm Bureau Executive Director Norm Groot, and myself. Agenda items included the 100 day plan and overall timeline, strategy/ vision, a marketing plan, financial considerations, and the value proposition. The creation of an innovation/incubation center and research focused on renewable resources was discussed, as was the need to develop a strategic plan and subsequent marketing plan. It was decided that a network of key stakeholders should be established with an eye on attracting corporate interest and advancing education and entrepreneurial initiatives. Measures of effectiveness over time would include the amount of investment generated, job creation, number of new businesses/start-ups, progress on an innovation roadmap, and branding. The strategic vision of the overall effort would remain focused on renewable resources: agriculture, water, waste management, and energy. The group recognized the need for a systemic approach to growth and sustainability. At the end of the meeting, I was invited to attend all future meetings of the Executive Committee.

## **An Industrial Cluster and the Bloomberg Mayor's Challenge**

The next Executive Committee meeting was convened in the City Manager's Conference Room on August 2, 2012. Attendees included Mayor Donohue, Ray Corpuz, Jeff Weir, Sergio Sanchez, John Hartnett, Garland Thompson, Jr. and myself. The agenda covered a review of previous meeting minutes, an update on CapOne meetings, progress on the establishment of a 501c3 for public/private cooperation, the awarding of a \$147,000 Economic Development Association grant, the Strategic Plan, progress on the development of a Coder Dojo program in Salinas, the potential involvement of the Kauffman Foundation in developing a series of entrepreneurial training seminars, and a Salinas project plan provided by John Hartnett. During this meeting, consistent with the concept of developing an industrial commons (or cluster) it was decided to seek partnerships with several Universities and Colleges that were either located in the area or that would be interested in agriculture technology research. Institutions initially identified included University of California, Davis, University of California, Santa Cruz, California Polytechnic College (Cal Poly), California State University San Jose, Hartnell College, Georgia Tech Research Institute, and University College, Dublin. Additionally, Mr Garland Thompson was introduced as a new member of the Executive Committee to serve as the Project Manager for initiatives already in progress.

Significantly, the agenda also covered a presentation by Jeff Weir in which he described an opportunity for the city of Salinas to compete in the Bloomberg Mayor's Challenge, sponsored by the Bloomberg Philanthropies. According to the Bloomberg Mayor's Challenge website:

**Bloomberg Philanthropies** is inspired by the opportunity to find and spread innovative local solutions to national problems. We created the Mayors Challenge to celebrate the creative problem solving and incredible innovation that is happening in city halls from coast to coast. The five boldest ideas with the greatest potential for impact will win funding as well as national and local recognition.

This challenge is all about identifying a need, solving a problem, and sharing your knowledge so that other cities and citizens can benefit from your insight and actions. (Bloomberg Mayor's Challenge, 2012)

It was decided in the meeting on August 2, 2012 that a response to the Mayor's Challenge questionnaire could serve as a vehicle for the Steinbeck Innovation Team to develop a coherent strategy and marketing narrative. Cities interested in participating were required to submit their completed questionnaires no later than midnight on September 14, 2012. Five cities would ultimately be selected as winners, with four receiving \$1,000,000 each and one receiving \$5,000,000 as a grand prize. The on-line questionnaire provided 24 structured questions with strict word limits specified for each response. It was the consensus of the Executive Committee that this competition provided a great opportunity to capture a coherent vision and strategy for the City of Salinas, and win or lose, it would force the Team to synthesize various initiatives into one, coherent document. The thrust of the proposal would be the establishment of an industrial cluster to reinvigorate a manufacturing base that could provide jobs by leveraging the region's unique competitive advantages of fresh produce production and close proximity to the innovation and technology center of Silicon Valley. Education and research, countering the malign influence of gang activity, and community involvement would play a large role in this networked cluster strategy. System dynamics modeling would be used to better inform decision and policy makers as the strategy was implemented going forward. Garland Thompson was assigned the task of compiling and editing the initial inputs.

### **The Emergence of Organizational Structure**

John Hartnett subsequently e-mailed the meeting minutes from August 2 to the Executive Committee members. Highlights included an update on negotiations with CapOne aimed at gaining further facility or financial support, the decision to set up a 501c3 "Steinbeck Innovation Foundation," an agreement to kick-off the Salinas CoderDojo in the last week of August/first week of September (so that participating kids could attend a CoderDojo event in Hollywood, California on 27 September), the decision to pursue memoranda of understanding (MOUs) with named Universities/colleges to participate in research, and to reposition the "Industrial Commons" strategic initiative around "innovation clusters." Further, it was agreed that meetings would be scheduled for John Hartnett to meet with key local business leaders. In his e-mail, Hartnett cited the

Bloomberg Mayor's Challenge as a "fantastic opportunity" and it was noted that a Kauffman Foundation entrepreneurial trainer had been secured to assist those affected by the HSBC layoff.

Immediately following the August 2 meeting, Jeff Weir sent a notice to Executive Committee members delineating a schedule for future meetings:

The full Steinbeck Innovation Team will meet on the third Thursday of each month from 2:00–4:00 PM in August, September and October and then once each quarter beginning in January 2013. The meetings will be held in the CEDD Large Conference Room, 2<sup>nd</sup> Floor, Permit Center, 65 West Alisal Street.

The Executive Team will meet on Thursday of each week from 2:00–4:00 PM except for the date of full SIT meetings when the EC will meet at 1:00 PM prior to attending the full SIT meeting. The first week and third week of each month the meetings will be held in Salinas. The first weeks meeting will be in the CMCR and the third week at the CEDD LCR. The second and fourth Thursday meetings of the EC will be held in San Jose at the ITLG facility. These meetings will also be from 2:00–4:00 PM. (J. Weir, e-mail, August 2, 2012)

Of note, while the composition of the larger Steinbeck Innovation Team varied meeting to meeting, it generally consisted of senior leadership from local colleges, senior members of the local business community, representatives from the Monterey County Farm Bureau and the Shipper-Grower Association, and selected members of the Salinas City Council in addition to the members of the Executive Committee already named.

Within days of the August 2 meeting, Jeff Weir and attorney Matt Ottone submitted the Articles of Incorporation and Bylaws for the Steinbeck Regional Innovation Foundation to State offices in Sacramento. Garland Thompson began solidifying plans to establish a Coder Dojo in Salinas and collecting inputs for the Bloomberg Mayor's Challenge. I sent the Executive Committee my paper, "Engineering an American Industrial Commons Revised" (Porter, 2012) to help provide some ideas for the overarching vision and strategy to be articulated in the Bloomberg Mayor's Challenge entry. Lon Hatamiya's *Salinas Economic Development Strategy 2011* (cited in my paper) was also forwarded to Garland Thompson by Jeff Weir. In the meantime, John Hartnett

asked me to help him reformat a non-binding memorandum of understanding for school's interested in participating in research with the Steinbeck Innovation Team.

The next Executive Committee meeting was held on August 9, 2012. Significant progress on the Salinas CoderDojo was discussed and it was briefed that the Salinas Library technical staff would work with Hartnell College to provide a venue, internet access, and staff. Funding would be worked out with the city. Brian Fitzgerald was identified as the lead on Kauffman Foundation training. LuAnn Meador had begun to reach out to the California Vintners Association to attract winery business and potential light manufacturing to the area. John Hartnett set a goal of raising \$5,000,000 from various sources to serve as an innovation fund. The first draft of the Bloomberg Mayor's Challenge response was set to be completed on 13 August, with a draft ready for Executive Committee Review at the meeting scheduled for 16 August. City Manager Ray Corpuz explained that Development Counselors International (DCI) had been retained by the City of Salinas to create a "Grow Salinas" marketing campaign, and it was decided to get them in touch with John Hartnett to coordinate activities.

On August 13, 2012 Garland Thompson sent the first draft of the Bloomberg Mayor's Challenge to the Executive Committee for review and it was discussed in a conference call. Comments were incorporated in a draft that was prepared for the upcoming August 16 meeting of the Executive Committee. The day before the meeting, John Hartnett notified Garland Thompson that he had spoken with Una Fox, Vice President of Technology at Disney Corporation who was heading up the Los Angeles CoderDojo. She had invited kids from the Salinas CoderDojo to attend an event at Sony Pictures on 27 September. Garland agreed to arrange for a competition among those participating in the Salinas CoderDojo to attend the event and to create a flyer, announcing the establishment and first meeting of the Salinas CoderDojo.

### **Project Plan and Initial Strategy Concept Development**

Prior to the meeting on August 16, John Hartnett sent out an agenda and an update of the Steinbeck Innovation Project Plan he had developed (Figure 2). This plan illustrates both the near term and long term systems approach he had adopted for the

project, integrating aspects of strategic planning, marketing, communications, education/training/research, finance, and incubation/start-ups over a two year period. While pursuing an initial 100 day plan to mitigate the anticipated impact of the CapOne job losses, it was clearly understood that there needed to be a longer term vision and plan to achieve identified objectives. While this plan had not yet materialized, the Bloomberg Mayor's Challenge was helping to bring the vision into focus. Worth noting is that the milestone, "Create Strategic Plan," consisting of vision, strategy, and infrastructure was projected to be completed in December, 2012 (see Figure 2).



Steinbeck Innovation Project Plan		2012								2013				2014			
Activity Category	Owner	May '12	Jun '12	Jul '12	Aug '12	Sep '12	Oct '12	Nov '12	Dec '12	Q1/13	Q2/13	Q3/13	Q4/13	Q1/14	Q2/14	Q3/14	Q4/14
<b>Initial 100-days</b>																	
<b>Organisation, Infrastructure and Planning</b>																	
Exec committee (SEC)	JH																
Set-up Team (SIT)	Dennis																
Set-up Overall Approach & Game plan	JH																
Situation Analysis	JH																
<b>Infrastructure</b>	Jeff, Ray																
501(c3)																	
<b>Objectives</b>	SEC																
<b>Resolve Capital One Agreement</b>	Dennis, J.H.																
Meet Capital One team	Dennis																
Send exec. Letter, Copy CEO	JH, Dennis																
Arrange executive meeting	Dennis																
Negotiate & Finalize agreement	JH, Dennis																
Meet Building Owner Queenscare	SEC																
<b>Steinbeck Innovation Village</b>																	
Negotiate 25-50K in sq.ft.	SEC																
Advanced Research Center	SEC - Jim Lugg																
Incubation / Start-ups	SEC																
Services	SEC																
Corporate / Strategic	SEC																
Day Care	SEC																
<b>Create Strategic Plan</b>	Wayne																
Vision	Wayne																
Strategy	Wayne																
Infrastructure	Wayne																
Implement Industrial Commons	SEC																
<b>Create &amp; Implement Marketing Plan (DCI)</b>	Jeff																
SWOT																	
Value Proposition																	
Analysis (Short-term)																	
Implement (Long-term)																	
<b>Communications Plan</b>	SEC																
<b>Target Top Corporate Prospects for Salinas</b>	Dennis, JH																
Silicon Valley venture capitalists																	
Dupont																	
<b>Establish Network / Event Calendar</b>	Dennis																
Establish local & Mexican network	Dennis, JH																
Establish Events Calendar (Ted/Arts)	SEC																
<b>Education / Entrepreneurial</b>	Rodrigo, Sergio																
Kauffman	JH / BF																
Coder Dojo	Sergio																
Other (TBD)	SEC																
University MOUs	Wayne																
<b>Key Initiatives</b>	Luann, Kurt																



Cyber security	Rodrigo																
San Jose partners	Dennis																
Wine Industry	Luann																
<b>Measurements / Results</b>	<b>SEC</b>																
Investment																	
Job Creation																	
New Business / Startup																	
New Business / Corporate																	
Innovation Roadmap																	
Brand / Image																	
<b>Finance</b>	<b>Sergio, Ray, Jeff</b>																
Economic Development Funding—147K	Ray																
Economic Development Fund 2—100K	Jeff																
CapOne Investment	Dennis																
Economic Development Facilities—750K	Jeff																
Other Investment	SEC																
Budget	Jeff																
Bloomberg Challenge	Garland																
Create innovation fund (\$5 million)	SEC																

Figure 2 Steinbeck Innovation Project Plan

## **The Launch of CoderDojo and Progress on the Bloomberg Mayor's Challenge**

The Executive Committee meeting on August 16, 2012 was primarily intended to provide an update on the two most urgent initiatives then underway: the Bloomberg Mayor's Challenge entry, and the establishment of a CoderDojo program for Salinas's youth scheduled to have an open house on August 25 in the Salinas Library. The City of Salinas initially pledged \$30,000 in CapOne grant funds to launch the CoderDojo in partnership with Hartnell College. The group also discussed progress being made on MOUs for selected Colleges and Universities, and I mentioned that Dr. Dennis Folds, Chief Scientist at Georgia Tech Research Institute, would be visiting me on 23 August and was planning to attend the Steinbeck Innovation Team meeting. Dr. Folds, who had experience in modeling a large-scale project for the State of Georgia, was interested in the research I was doing in system dynamics modeling at NPS and its potential application to the Salinas cluster project. John Hartnett provided an update on his meetings with Silicon Valley banks to generate interest in an innovation fund (as part of his Steinbeck Village initiative), and Ray Corpuz discussed DCI's role in marketing an overall development plan for the City of Salinas. Progress on securing Kauffman Foundation training and an overview of the financial situation were also presented. Erin Fogg, a media consultant from Spoke Consulting who had previously done work for the City of Salinas, attended the meeting and Mayor Donohue mentioned that she would now be helping with communications planning and preparation of the Bloomberg Mayor's Challenge. Finally, the Executive Committee planned agenda items for the larger Steinbeck Innovation Team meeting scheduled for August 23. It was decided that while the Bloomberg Mayor's Challenge would be discussed with the larger group, responsibility for drafting the entry response would remain with the Executive Committee.

The Executive Committee meeting on August 28, 2012 covered significant progress across the spectrum of John Hartnett's Project Plan. In addition to the regular members of the Executive Committee, the group was joined by Dr Dennis Folds, from Georgia Tech Research Institute (GTRI) and Tim Richardson, a local businessman and

consultant for GTRI, Erin Fogg, and attorney Matt Ottone. Hartnett provided a strategic project overview for Dr Folds and Mr Richardson, and Dr Folds discussed his use of modeling to inform policy-makers in the State of Georgia who were engaged in strategic planning for state-wide projects (e.g., education, health care, employment, etc). CapOne had pledged approximately \$1.6 million (M) to Salinas community projects and the United Way to help off-set the impact of the facility's closing. The Mayor discussed the status of talks that were continuing with CapOne local leadership in considering the possible use of the large HSBC/CapOne Salinas banking services facility for an Innovation Village/incubation center. John Hartnett and Jeff Weir had already conducted a site visit of the HSBC building with this in mind. It was hoped that Kauffman Foundation entrepreneurial and employment training could be linked to this effort. Hartnett and Mayor Donohue were preparing a list of companies with financial interests in the area that might be approached for support. The University MOUs were discussed, and it was decided that it might be possible to approach the University of California Regents to bring UC Davis, UC Santa Cruz and UC Berkeley into the cluster. Matt Ottone covered the structure of the proposed Steinbeck Regional Innovation Foundation 501c3 and the articles and by-laws he had submitted to the State for incorporation.

Perhaps the most significant projects discussed on August 28 were plans for the Salinas CoderDojo and the Bloomberg Mayor's Challenge entry, now in its second draft. Garland Thompson reported that two dates had been agreed upon for the CoderDojo launch at Hartnell College with support from the Salinas Library and Community Services Director: an open house on 25 August; and, the first planned session of the CoderDojo on September 8<sup>th</sup>. Flyers, banners, a website, an e-mail address, Facebook and Twitter accounts were already being generated and City Manager Ray Corpuz had approved the requested budget. John Hartnett related his conversation with CoderDojo founder, James Whelton, who had offered help and advice. Hartnett also mentioned his conversation with Una Fox, Head of Technology for Disney. He said that she was excited about bringing participating kids from Salinas down to a CoderDojo event in Los Angeles. It was decided to pursue an overnight, chaperoned trip for 5–10 kids.

The focus of the meeting then shifted to progress in drafting the Bloomberg Mayor's Challenge entry. Erin Fogg would be assisting with the document's preparation and wording, gathering inputs from Garland Thompson and members of the Executive Committee. A meeting of the larger Steinbeck Innovation Team ensued, covering much of this information. Afterwards, Erin Fogg, Dr Folds, Tim Richardson, Mayor Donohue, and I met in the Mayor's office to discuss the overall vision of the Steinbeck Innovation project, the establishment of a cluster focused on sustainable agriculture, and the role modeling could play in this process. Erin hoped to develop major themes of sustainability in a Steinbeck Innovation communications plan.

On August 27 2012, an article appeared in the *Salinas Californian* newspaper recounting the introductory meeting of the CoderDojo that had taken place on August 25 (Figure 3). The article, entitled, "*Hartnell, Salinas Launch Tech Club*," stated that, "The 'CoderDojo' will be free and focus on helping young people, ages 8-17, learn how to develop websites, apps, games and other computer technologies. Its first meeting is Sept 8. Parents are welcome and encouraged to attend with their kids." Garland Thompson was quoted, saying, "Given Salinas' proximity to Silicon Valley, it just makes sense that we give our kids every opportunity to excel in computer technology... the dojo will be a club driven by the kids themselves." Thompson went on to add that the dojo would have one simple rule: "Above All: Be Cool –bullying, lying, wasting people's time and so on is uncool" (Mitchell, 2012) This was the first article published in the Salinas area that would address aspects of the Steinbeck Innovation Team's work, though the Team was not cited. It is evidence of a systemic approach that sought to ingrate the community in a longer-term strategy of economic development.



Figure 3. Introductory Meeting of the Salinas CoderDojo (photo provided by Garland Thompson, pictured on left).

### **Strategy Formulation**

On September 13, 2012, the Executive Committee convened a teleconference to discuss John Hartnett's initial formulation of the strategy as it had emerged from the input gathered for the Bloomberg Mayor's Challenge, and to finalize the actual entry from the City of Salinas. Prior to the conference, Hartnett's conceptual drawings of the strategy were sent to members of the Executive Committee, as was the final draft of the response that had been iterated several times with members of the Committee and compiled by Garland Thompson and Erin Fogg. Hartnett's initial drawings are provided in Figures 4, 5, and 6.

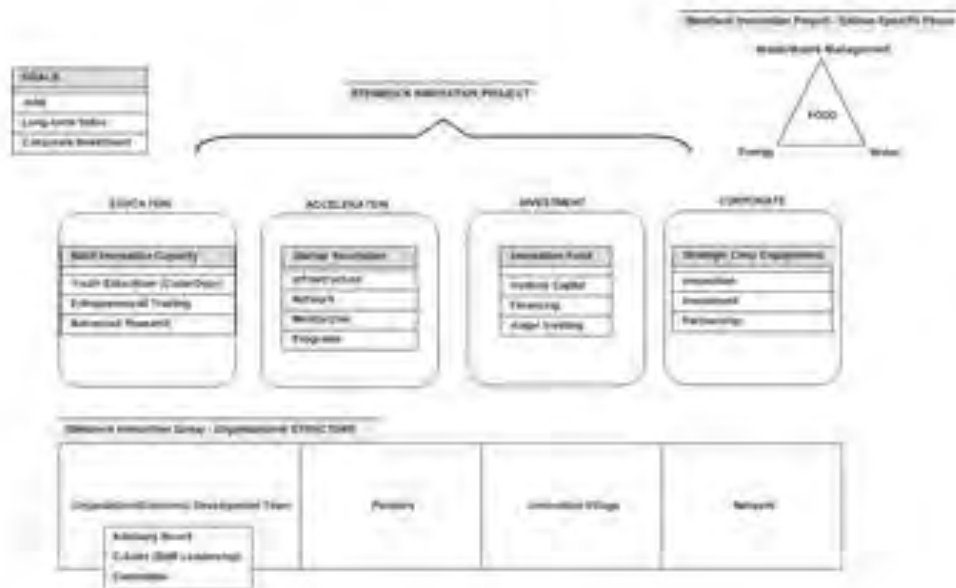


Figure 4. Initial Drawing 1 (from Hartnett, 2012)

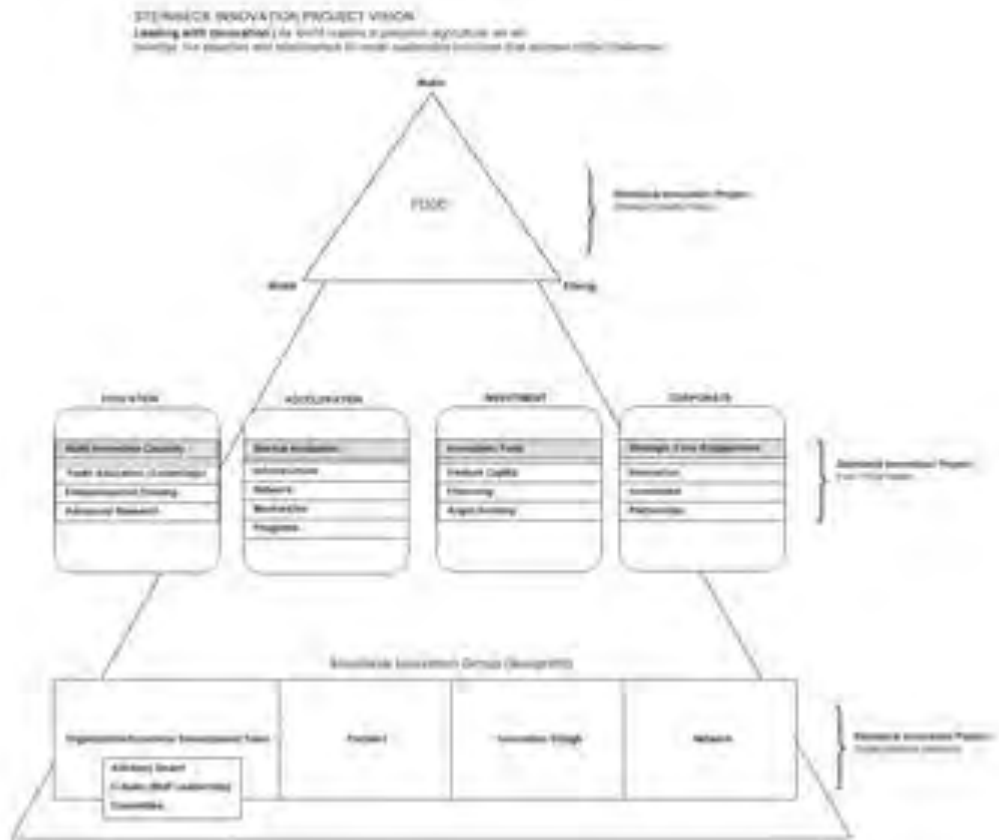


Figure 5. Initial Drawing 2 (from Hartnett, 2012)





incorporated in the document immediately following the meeting. On 14 September 2012, the City of Salinas submitted its entry application to Bloomberg Philanthropies. This document provided the framework for the Steinbeck Innovation Project and would serve as the basis for further strategic planning over the next several months.

The next Steinbeck Innovation Team meeting was held at the Grower-Shipper Association in Salinas. This was an opportunity to brief the larger Steinbeck Innovation Team on progress to date, including the submittal of the Bloomberg Mayor’s Challenge document and the first meeting of the CodorDojo on 8 September. A representative of DCI also provided an update on the marketing plan the company was developing for the City of Salinas. Additionally, John Hartnett provided a more polished slide depicting the Steinbeck Innovation Project based on earlier drawings provided to the Executive Committee (Figure 7).



Figure 7. Steinbeck Innovation Graphic (from Hartnett, 2012)

Hartnett's graphic would continue to evolve over time through the strategic planning process already discussed; it became evident that the vision and approach were well served by this preliminary graphic.

On September 21, 2012, I was invited by Paul McNamara from San Jose State University to tour the Moss Landing Marine Laboratories, a facility servicing California State Universities in the area. During this meeting, I learned of work being done by Dr Michael Graham, a professor of phycology at the lab, and others involved in the advancement of marine biology and aquaculture science. It was clear to me that work Professor Graham had done with the local Marina High School to interest students in the commercial applications of marine science was a model that could be replicated in Salinas with a focus on agricultural science and technology. It was also readily apparent, that if the Steinbeck Innovation Project was to create a regional cluster, there were ecological as well as educational and economic advantages in expanding the scope of the strategy to include aquaculture interests from coastal areas. The concepts of sustainability that were being applied to the agricultural areas inland, were directly impacted by, and must systemically include, water, soil, energy, and waste/nutrient management issues affecting coastal areas and populations.

Coincidentally, a week earlier, I had discussed with local entrepreneur and Stanford University professor, Brent Constanz, an environmentally-aware, commercial desalination project he was pursuing that was located in close proximity to the Moss Landing Marine Labs. This project could have implications for the entire region, and might contribute to the restoration of the riparian system that had been degraded over time in Monterey County. I left the meeting at the Moss Landing Marine Labs (MLML) determined to suggest the Executive Committee consider the inclusion of aquaculture as a primary strategic aspect of the Steinbeck Innovation Project. I subsequently forwarded to Mayor Donohue several documents I had been provided by the MLML and mentioned that bringing aquaculture and coastal communities into the Steinbeck Innovation Project could be part of a "sea to valley" or "sea to soil" approach.

### **Key Hubs, Connectors and a Regional Approach**

On October 11, Mayor Donohue, John Hartnett and I met with Bruce Taylor, CEO of Taylor Farms, and Margaret D'Arrigo, Taylor Farms Vice President of Community Development in Mr Taylor's office. The purpose of the meeting was to apprise Bruce Taylor, largely recognized as the most influential business leader and in the local agricultural community and City of Salinas, of the Steinbeck Innovation Project and to discuss the role me might play in the effort. Mr Taylor was very receptive to John Hartnett's explanation of the project and it was decided that Margaret D'Arrigo, herself a well-respected figure in the agricultural and education community sectors of Salinas, would join the Steinbeck Innovation Team as Taylor Farms' representative. It had been decided early on that to be successful, the strategy needed to include the development of a network of key "hubs" within the community. These hubs would serve as bridges or connectors between business, education, research, investment, and civic sectors required to form a cluster. The involvement of Bruce Taylor and Margaret D'Arrigo would be critical to advancing interest and participation in the development of a cluster in Salinas and the region.

More significant progress was made in the strategic planning process at a meeting of the Executive Committee held in John Hartnett's ITLG conference room in San Jose on 15 October, 2012. The meeting was attended by John Hartnett, Mayor Donohue, Erin Fogg and me. The purpose of this meeting was explicitly to allow John Hartnett to share the business framework for the long term strategy he had been developing based upon the inputs and collaboration that had contributed to the Bloomberg Mayor's Challenge. Focused on creating a cluster centered on the region's existing central economy—agriculture and to a lesser extent, now to include aquaculture—and supported by the sustainable management of water, energy, and waste, Hartnett proposed four central pillars: Investment; Corporate Sponsorship; Acceleration; and, Innovation. The Investment Pillar would include debt financing, venture investments, angel investments, a Grow Salinas fund, and major private investors. The Corporate Pillar would include major corporations both local and national with interests in agriculture, IT technologies, water and energy generation, and food/wine services. The Acceleration Pillar would

include an “Incubation Center” to link together entrepreneurs, universities, Veterans, and on-site support and training and would be funded through corporate partners, local investors, and individuals. The Innovation Pillar would include youth-education and colleges and universities interested in signing non-binding MOUs to participate in the cluster.

It was agreed in that meeting, that to be successful, the cluster had to be regional in nature, roughly to include all of Monterey County and parts of neighboring Santa Cruz county. In essence, this would not be a “county-driven” or a “city-driven” cluster, but would cover the region from “sea to soil,” from the coast to the inland agricultural valley. Branding would be critical for the communications and marketing campaigns and the group debated whether to simply refer to this as a “Regional Cluster.” Hartnett, himself, came up with a branding solution that would avoid civic and political squabbling over ownership. He suggested it be known as the “Steinbeck Cluster,” spanning not just Monterey and Santa Cruz county areas, but capturing all of “Steinbeck Country” and the literary beauty and legacy associated with the region. The Executive Committee immediately agreed on this name and on Hartnett’s framing of the four pillars that would underpin the strategy of developing a sustainable economic cluster.

On 17 October, Mr Brent Constanz and associates of his, met with Mayor Donohue, Salinas City Manager Ray Corpuz, and John Hartnett in the Mayor’s conference room to discuss regional water constraints and the potential role Constanz’ proposed Deep-Water Desalination project could play in the City of Salinas water planning and in the Steinbeck Cluster. Constanz and his associates made the argument that if sufficient water could be supplied to the region, it would incentivize IT-related industries linked to the Silicon Valley to seek manufacturing facilities in Salinas and the surrounding areas. This was consistent with the strategy for the Steinbeck Cluster that had been discussed earlier and both the Mayor and City Manager expressed interest. Before the meeting ended, it was suggested that the participants might pursue the establishment of an MOU between Deep-Water Desalination and the Steinbeck Cluster or City offices.

On 18 October a meeting of the larger Steinbeck Innovation Team was convened at Hartnell College, co-hosted by Mayor Donohue and John Hartnett and Hartnell's new President, Dr. Will Lewallen. The group included representatives from California State University Monterey Bay, University of California Santa Cruz, California State University San Jose, DCI, Rabobank, the Grower-Shipper Association, and others already associated with the Steinbeck Innovation Team and Executive Committee. John Hartnett provided an overview of the Steinbeck Project strategy and his business model for the four pillars. The Bloomberg Mayor's Challenge was discussed as well as progress that has been made on the CodorDojo that Hartnell College was co-facilitating with the Salinas Library. The scope of the Steinbeck Cluster was broadened to include the region and its agricultural and aquacultural interests. Margaret D'Arrigo was introduced as representing Taylor Farms. Particular emphasis was placed on the emerging effort to establish Memoranda of Understanding with local colleges and universities that share specific research interests with the Cluster: alternative energy, agriculture technology, commercial aquaculture, education initiatives for students, etc. Updates were also provided on DCI's marketing plan, the establishment of a Steinbeck Regional Innovation Foundation 501c3, and plans for Kauffman Foundation entrepreneurial training. Outcomes from the meeting included the consideration of using "Steinbeck Cluster" as the unifying title for the overall Steinbeck project and Foundation, the need to incorporate aquaculture into the strategy as a complement to the focus on agriculture, and the drive to establish an Innovation Center in downtown Salinas. Margaret d'Arrigo confirmed that Bruce Taylor had expressed interest in helping to identify an appropriate facility. Updates were also provided on progress with CapOne and various initiatives to help employees facing layoff from HSBC find suitable employment in the area.

On 25 October, I delivered a presentation at Arizona State University's Global Institute of Sustainability as the Wrigley Guest Lecturer. I had been invited to speak by Professor Jim Elser, and the event was hosted by the Institute's Dean, Dr Sander van der Leeuw. This speaking engagement presented me the opportunity to meet with several research scientists involved in the very areas of research that bore on the Steinbeck Cluster: nutrient recovery, water management, alternative energy, soil sustainability, K-

12 education, and community outreach. While my presentation, entitled, “The Darwinian Moment: A Narrative for Adaptation” was broad in scope, it allowed me to briefly address the vision and specific approach being taken by the Steinbeck Innovation project. In my meetings with Dr Elser, his associates, and with Dean van der Leeuw, there was significant interest expressed in ASU’s potential involvement as a partner in the Steinbeck Cluster. Jim Elser promised to follow up with me, and plans were made for a site visit to Salinas for members of the Institute’s faculty.

### **Smart Farms**

A few days after returning to NPS, Mayor Donohue forwarded me an IBM document entitled, “Precision Agriculture: Smarter Farming to Feed a Smarter Planet.” In that document, the following definition was provided:

What is Precision Agriculture?

Precision Agriculture means using data to help farmers make more precise decisions in order to operate more efficiently. It helps protect the food supply all of us depend on, and it helps protect farmers’ livelihoods.

Planting and harvesting typically happen on a predetermined schedule. However, by collecting real-time data on weather, soil and air quality, crop maturity and even equipment and labor, *predictive analytics can be used to make smarter decisions and maximize resources*—everything from selecting the best harvest date to avoid crop damage, to how many workers will be needed to harvest crops in the next 36 hours before freeze or flood, to how many delivery trucks should be staged in the field to immediately ship out produce from farm to warehouse. (IBM, 2012)

The notion of precision agriculture seemed very well aligned with the Steinbeck Cluster strategy and was along the same lines of research I had discussed in my meetings at ASU. I subsequently had the chance to discuss this with Mayor Donohue at NPS and with John Hartnett in a phone call. They agreed that precision agriculture seemed to be a useful unifying concept worth incorporating into the strategy since it provided the logical linkage between big data and IT interests in Silicon Valley to commercial agriculture and aquaculture businesses in the Steinbeck Cluster.

At the end of October, Mayor Donohue shared a presentation he had seen at a Future Farm event with John Hartnett and me. The presentation was given by Katie Montano, then-Sustainability Manager for Driscoll's Strawberry Associates, a global supplier of berries located within the Steinbeck Cluster region in Watsonville, California. Ms Montano's presentation was entitled, "*Case Study: Driscoll's Strawberry Associates: Technology's Role in Solving Water Constraints and Regulatory Challenges.*" Driscoll's company motto was "sustainability," and the presentation was insightful, integrating sensor technology into the monitoring and control of water and crop nutrients to improve efficiency and to sustain the health of their croplands. It was agreed that Driscoll might be another key partner (along with Taylor Farms) in developing the strategy and its implementation.

On November 5, the City of Salinas was notified that its entry in the Bloomberg Mayor's Challenge had not been selected as one of the 20 finalists to compete for the five winning grants. While this was disappointing for the Steinbeck Executive Committee, it had little negative impact. The strategy that was emerging from the preparation of the Bloomberg Challenge entry was continuing apace among key members of the Executive Committee, led by John Hartnett. Hartnett and Erin Fogg had been working on the development of a communication strategy for the Steinbeck Cluster and Erin was creating a Steinbeck Innovation website. Additionally, John Hartnett had met with Barbara Sullivan, a former executive with Cisco Corporation who lived in the area, had experience in IT applications for large city development plans (Doha, Qatar), and was working on her own initiatives to increase IT involvement in the agriculture industry for global food sustainability. It was hoped that Barbara, whom I had introduced to John through my contacts at Georgia Tech Research Institute, would help further develop the strategy for the Steinbeck Cluster. Hartnett, Mayor Donohue, Margaret d'Arrigo and Barbara Sullivan had discussed the role Taylor Farms (and possibly now, Driscoll) could play supporting a Steinbeck Innovation Center.

In an e-mail on 8 November, John Hartnett provided an update on progress to the Executive Committee that concluded with the following comment:

Finally, having talked to a few corporates the focus today is very much on “Smart cities” and “Smart buildings”—I believe that we can own the concept of “Smart Farms” and drive this as an overall concept that helps focus our efforts and will attract the big corporates. Would love your feedback here? (J. Hartnett, e-mail, November 8, 2012)

This was John’s first mention of the term “Smart Farms,” and the terminology was well aligned with the precision agriculture concept we had discussed earlier. As a response, I sent the following comment back in an e-mail:

The essence of our strategy is that by combining the technology required to address economic sustainability, we must create the means of integrating smart cities with smart agriculture/aquaculture. This involves real time monitoring and control of our resources and the environment in which we live and work. I discussed with Dennis last night the ability to monitor our crops, livestock, water, and energy through an operational control center that merges the elements of our strategy (agriculture, water, waste, energy) into a single data center with regional, real time input (via remote sensors and robotics) to provide increased efficiency (output), security (from pathogens, climate aberrations, economic disruptions, etc), and long range awareness (by charting trends). This concept is exactly where money will be made in future technology, manufacturing, and export. This is the vision that will draw stakeholders (domestically and from abroad) to our Steinbeck Cluster, just as they have previously gravitated toward the Silicon valley for IC development, southern Germany for mechanical engineering, Boston for pharmaceuticals, etc. It is this concept that has already garnered the attention of folks at GTRI and Arizona State University’s Sustainability Institute (to name a couple of institutions from out of state that already recognize our unique ability to bring this together). The matrix I provided earlier is a very basic starting point for organizing our effort on potential stakeholders, investors, technologies, and education. (Porter, e-mail, November 8, 2012)

Hartnett agreed that this approach could play a major role in integrating the research the Steinbeck Foundation hoped to cultivate with universities and colleges interested in partnering with the Steinbeck Cluster.

On November 9, Mayor Donohue hosted a luncheon for a team of site-selectors who were visiting Salinas representing corporate interests. The Mayor was joined by John Hartnett, Ray Corpuz, and Jeff Weir to present an update on the Steinbeck Innovation Project. Other invitees included Dr Ochoa, President of CSUMB, Dr Lewallen, President of Hartnell College, William Barr, former Monterey County



Superintendent of Schools, and Andy Matsui, philanthropist and owner of Matsui Nursery (a large orchid supplier based in the area). The purpose of this luncheon was to acquaint the site-selectors with the Steinbeck Cluster strategy and to generate corporate interest in the “ag-tech” cluster concept.

### **Strategy Formalization and Launch**

On November 26, the Executive Committee conducted a teleconference to discuss progress on the communication strategy and the establishment of a website designed by Erin Fogg with John Hartnett’s input. A formal meeting of the Executive Committee was then convened on November 29 in the Mayor’s office in Salinas. The agenda for that meeting covered, among other things, the upcoming Mayoral Transition, Brent Constanz’s Deep Water Desal Project (with which the City of Salinas had now signed an MOU), and the planned formal public launch of the Steinbeck Innovation Project. The Steinbeck Innovation website would be posted to coincide with the formal roll-out of the Steinbeck Innovation project when Mayor Donohue turned his office over to Mayor-elect, Joe Gunter in December. Mayor Gunter pledged his support for the Steinbeck Innovation Project going forward. The anticipated launch of the Kauffman Foundation training program would be included in this roll-out announcement. It was agreed that the location of the Steinbeck Innovation Center would be downtown Salinas at a newly planned facility being constructed by Taylor Farms (anticipated to be completed in 2014) and potential temporary locations would be sought for 2013. Brian Fitzgerald, an associate of John Hartnett at the ITLG who had the lead in developing the Kauffman Foundation training program, was introduced as the Interim Executive Director of the Steinbeck Innovation Project. LuAnn Meador, who had been doing extensive outreach with the wine industry, had now been added as a member of the Executive Committee. The Executive Committee also discussed a shift in focus of the Steinbeck Cluster to “Smart Farms.” Plans were made to support an upcoming visit of a team from ASU’s Global Institute of Sustainability who were scheduled to meet with representatives of San Jose State University and the Moss Landing Marine Labs to investigate participation in the Steinbeck Cluster. It was decided that the visiting Team from ASU would meet with the Executive Committee in Salinas before returning to Arizona.

The month of December, 2012 marked the culmination of the Steinbeck Cluster strategic planning process and the establishment of the Steinbeck Regional Innovation Foundation, a 501c3 for public good. Throughout the month, there were a series of significant events, meetings, and announcements that would pave the way for the implementation of the Steinbeck Cluster Strategy through university and college research partnerships, education initiatives, and investment in both the Innovation Center and new business development.

On December 7, Mayor Donohue, John Hartnett, Erin Fogg, Brian Fitzgerald and I met with faculty and staff at the University of California Santa Cruz (UCSC) to discuss potential areas for research partnership. At this meeting, Brian Fitzgerald was introduced as the Steinbeck Innovation Project Interim Executive Director. During the meeting, Hartnett provided an overview of the Steinbeck Cluster strategy that had been developed. Integral to this strategy, he explained, was the establishment of research partnerships with local universities and colleges in specific areas of interest. UCSC was involved in a number of research areas that could support commercial interests in the Steinbeck Cluster, including localized alternative energy, water management, and information/data management related to small business energy efficiencies and farm labor. It was agreed that UCSC would review a draft Memorandum of Understanding with the Steinbeck Regional Innovation Foundation to enable the pursuit of cooperative research.

In support of the development of a communications strategy with John Hartnett, Erin Fogg prepared a new slide to represent the overall strategy of the Steinbeck Innovation Cluster (Figure 8). This graphic was then included in a slide deck that captured overall goals and the business plan of the Steinbeck Innovation Project and the Steinbeck Cluster, focused on Smart Farms. Eventually, this graphic would include references to aquaculture. Erin Fogg would incorporate the graphic and the accompanying slide deck into the website she was preparing for the official public launch of the Project now planned for December 14, 2012 to coincide with Mayor Donohue's farewell speech to the City of Salinas.



Figure 8. Steinbeck Innovation Graphic (from Fogg, 2012)

On December 13, the visiting team of research professors from the ASU Global Institute of Sustainability met with representatives from San Jose State University and the Moss Landing Marine Labs to explore potential cooperative research in support of the Steinbeck Cluster project. The meeting focused on regional synergies between agriculture and aquaculture and the role research could play in advancing commercial opportunities for sustainability in food, energy, water, and waste/nutrient recovery. Various aspects of ongoing scientific research were discussed, including sensor technology, algae and biofuel production, riparian recovery, agricultural run-off capture and contaminant mitigation, sustainable ocean farming, and an integrated approach to tailored K-12 Science Technology, Engineering, and Mathematics (STEM) education. Following the technical meetings, the participants met with the Steinbeck Innovation Executive Committee in the Mayor's conference room in Salinas. At that meeting, it was decided that the ASU team would identify specific areas of research they might be willing to partner in through a memorandum of understanding with the Steinbeck Regional Innovation Foundation.

### **The End of a Chapter and the Beginning of Another**

December 14, 2012 marked the culmination of the months-long strategic planning process with the public announcement of the Steinbeck Innovation Cluster, the launching of the official website, and Mayor Donohue's farewell speech to the City of Salinas. A media event had been planned in Salinas for the Mayoral turn-over and it had been decided by the Executive Committee to use this opportunity as the launching date for the Steinbeck Innovation Cluster. Erin Fogg managed the communication plan and the website and helped Dennis Donohue craft his speech. The media event was held in the Maya Cinemas in downtown Salinas, with members of the Executive Committee, the larger Steinbeck Innovation Team, and community leaders in attendance. The event was covered by all local news and media outlets. The press packet for the event included the event announcement and description of the project and a one-page description of the Steinbeck Innovation Project (Figure 9).



Figure 9. Steinbeck Innovation One-Pager (from Fogg, 2012)

In his speech, Mayor Donohue congratulated Joe Gunter on his election to Mayor, and provided a summary of the actions he had taken to address challenges and opportunities during his six-year term of office. In this address, the Mayor also announced the creation of the Steinbeck Innovation Cluster:

We Salineans, with new partners from the Silicon Valley, are introducing the world to a new development model, initiated by city government and led by private industry. Our model is composed of four pillars of development support: education (including training and advanced research); startup incubation, investment, and corporate strategic engagement. We will galvanize the region's agricultural industry—not only building local prosperity, but also cultivating a competitive industry focused on solving the world's food, water and energy-related challenges.

We will deploy innovation, advanced research, entrepreneurial drive, and venture investment to spur economic growth through precision agricultural expertise. We farmers know food, water, energy and waste management. With the same venture investment and innovative drive that built the Silicon Valley immediately north of Salinas, we will use our knowledge to move our industry forward and create a Smart Farms revolution that will educate our kids, create and restore jobs, and bring prosperity to our neighborhoods. **We are calling this the Steinbeck Innovation Cluster.** (Donohue, Farewell Address, December 14, 2012)

This announcement served to punctuate a closing chapter in the City of Salinas and the conclusion of the strategic planning process that had begun in earnest in April 2012. It also opened the implementation phase of the Steinbeck Innovation Cluster. Later in December, meetings were held with the President of San Jose State University, and by the end of the month, both ASU's Global Institute of Sustainability and San Jose State University had signed MOU's with the Steinbeck Regional Innovation Foundation to partner on research. In December the Steinbeck Regional Innovation Foundation was formally established, and in the coming months the focus shifted to executing the strategy that had been developed.

## **APPENDIX B. MODELING MODULES**

# **System Dynamics Modules**

### **Investment for Education, Research, and New Business Start-ups/Jobs**

This module features six stocks: Steinbeck Funds; Research and Education Fund; Investment Fund; Start-ups; Bought Out; and, Failed Businesses (Figure 1).

Because this was a purely conjectural model based on projections of investment made as part of the Steinbeck Cluster Strategy, there was no historical data upon which to base the equations. Assumptions were made based on projections for investment and structures derived from the strategic planning participants.

The Steinbeck Fund was modeled as receiving Cash Flow In from Investors to Investment that was a function of initial Investors/Investment (graphing function that rose to \$20M over the first 8 years, then fell to approximately \$3M a year for the run of the model) plus additional funds from Grants for Research and Ops (modeled as a graphing function that begins with \$2.9M and drops rapidly over 8 years to a maintenance input of slightly more than \$100K per year for the run of the model), plus additional funds received from return on investment (from successful Start-Ups and Start-Ups that were Bought Out by other companies), minus investment dollars lost to Failed Businesses. The Steinbeck Fund was initialized at \$5M and Start-ups 1 was initialized with 3 (based on three actual start-ups that were anticipated to be funded quickly). Failed Businesses and Bought Out were initialized at 0.

The Outflows from the Steinbeck Funds were modeled as a combination of Operating Costs and Staff (initially set at 10 percent of funds received); Flow to Research and Education (initially set to 20 percent); and, Flow to the Investment Fund (initially set at 70 percent).

The Research and Education Fund has outflows to both Research Dollars Spent (85 percent of Research and Education Fund) and to Education and Training Dollars

Spent (5 percent of Research and Education Fund to CoderDojo and Other, and 10 percent of Research and Education Fund to Kaufmann Training). The Research and Education Fund was initialized at \$200K.

The Investment Fund has a single outflow to Investment in Projects, which is a function of dollars available for investment, Accelerator projects ready for investment, Shovel Ready Projects ready for investment, and the availability of a Thick Labor Pool (input from another module). Accelerator projects are in turn, a function of Commercial Applications for Investment (derived from Research dollars), and Entrepreneurs (derived from Kaufmann Training graduates), provided the Thick Labor Pool was above a threshold of 250. Shovel Ready projects were modeled as one a year, provided the Thick Labor Pool was above a threshold of 250.

The Start-ups pool has an input rate that is a function of Investment in Start-ups and Investment Conversion to Start-ups that is determined by investment dollars available at the time the Start-ups seek investment. Each Start-up was estimated to need \$1,500,000 and a Thick Labor Pool greater than 250 skilled employees (incentive gradually increasing as graphing function of Thick Labor Pool grew to reach 250 and more over early years of the model run).

The Start Up pool had two outflows: Start-ups Bought Out by other companies; and, those Start-ups that become Failed Businesses. The Buyouts rate of Start-ups was estimated to be 5 percent. The Out of Business rate for Start-ups was estimated to be 40 percent.

Start-ups that remained viable, and those Bought Out, contributed to Jobs, with the assumption that each Start Up would create an average of 200 jobs.

Start-ups that remained viable were modeled as returning 15 percent of \$1M each to Investment; Start-ups that were Bought Out were modeled to return 15 percent of \$2M each to Investment.

Start-ups that failed were modeled to decrement \$1.5M each from Investment.



Commercial Applications from Proven Technology were modeled as requiring an investment of \$500K each with a 2 year delay built in for product development.

The number of Kaufmann Graduates was estimated by dividing 10 percent of total dollars Spent on Education and Training by 1000 with the bulk of investment here occurring in the first 10 years.

The number of CoderDojo and Other Students was estimated by dividing 5 percent of total dollars spent on Education and Research by 100 with the bulk of investment here occurring in the first 10 years.

Dollars for Research and Education, therefore, was focused on the first ten years of the model run, the assumption being made that as Gang Membership diminished and the city's economy improved there would be less incentive to invest in the Coder Dojo program.

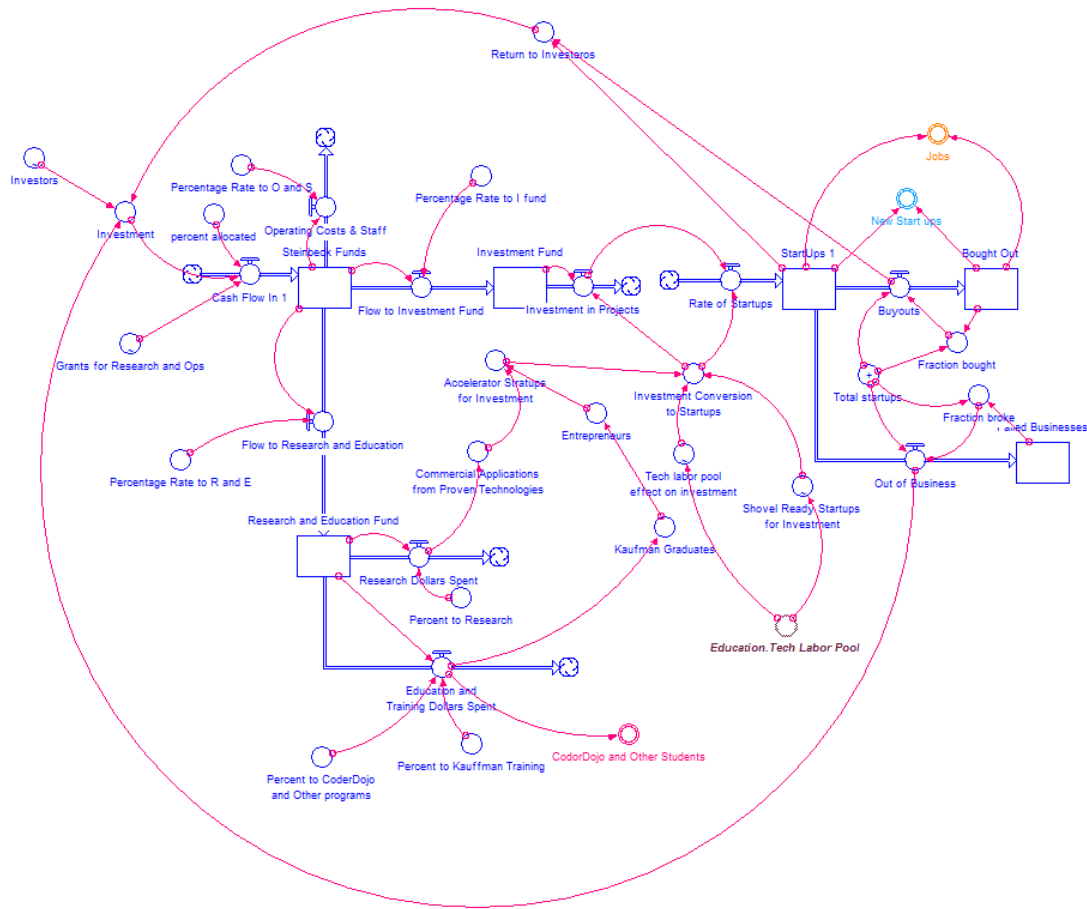


Figure 1. Investment for Research, Education, Start-Ups/Jobs

### Equations for Investment for Research, Education, Start-Ups/Jobs Module

$Bought\_Out(t) = Bought\_Out(t - dt) + (Buyouts) * dt$

INIT Bought\_Out = 0

INFLOWS:

$Buyouts = Total\_startups * (0.05 - Fraction\_bought)$

$Failed\_Businesses(t) = Failed\_Businesses(t - dt) + (Out\_of\_Business) * dt$

INIT Failed\_Businesses = 0

INFLOWS:

$Out\_of\_Business = Total\_startups * (0.4 - Fraction\_broke)$

$Investment\_Fund(t) = Investment\_Fund(t - dt) + (Flow\_to\_Investment\_Fund - Investment\_in\_Projects) * dt$

INIT Investment\_Fund = 700000

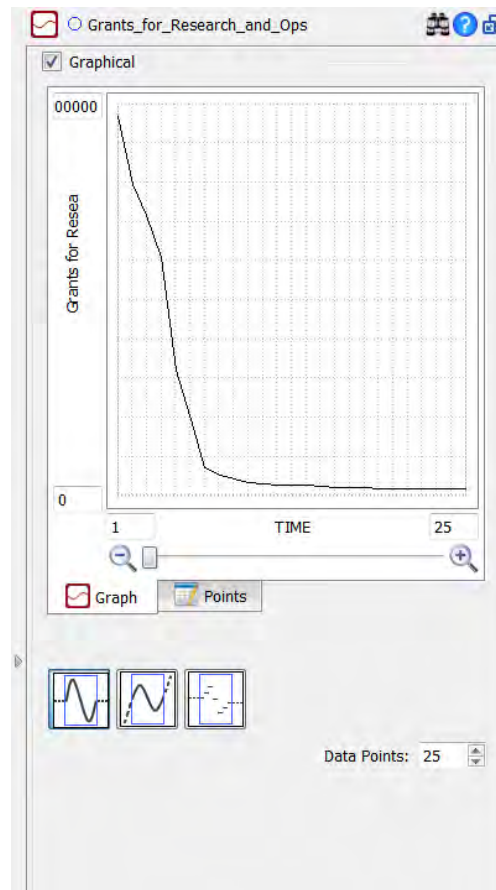
INFLOWS:

$Flow\_to\_Investment\_Fund = Steinbeck\_Funds * Percentage\_Rate\_to\_I\_fund$

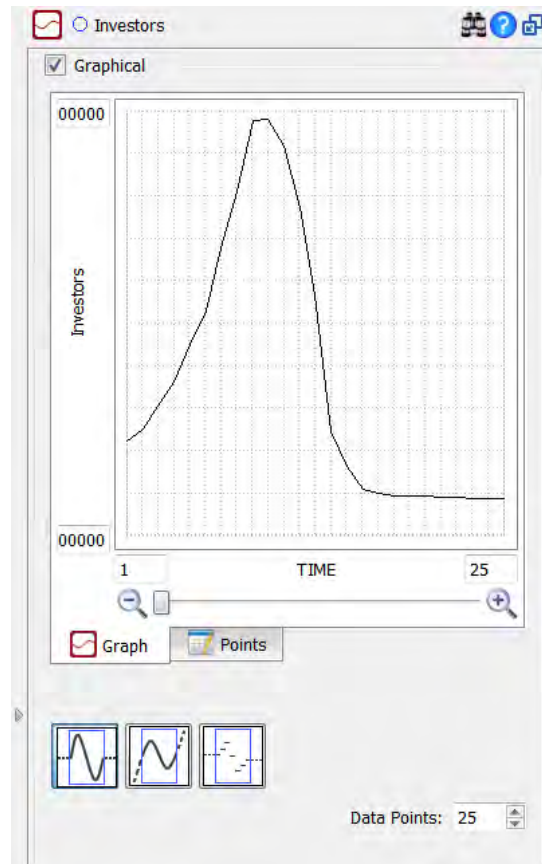
OUTFLOWS:

Investment\_in\_Projects=IF(Investment\_Fund>Investment\_Conversion\_to\_Startups)THE  
N(Investment\_Conversion\_to\_Startups)ELSE(0)  
Research\_and\_Education\_Fund(t)=Research\_and\_Education\_Fund(t-dt)+  
(Flow\_to\_Research\_and\_Education-Research\_Dollars\_Spent-  
Education\_and\_Training\_Dollars\_Spent) \* dt  
INIT Research\_and\_Education\_Fund = 200000  
INFLOWS:  
Flow\_to\_Research\_and\_Education = Steinbeck\_Funds\*Percentage\_Rate\_to\_R\_and\_E  
OUTFLOWS:  
Research\_Dollars\_Spent = Research\_and\_Education\_Fund\*Percent\_to\_Research  
Education\_and\_Training\_Dollars\_Spent=Research\_and\_Education\_Fund\*(Percent\_to\_K  
auffman\_Training+Percent\_to\_CoderDojo\_and\_Other\_programs)  
StartUps\_1(t) = StartUps\_1(t - dt) + (Rate\_of\_Startups - Buyouts - Out\_of\_Business) \* dt  
INIT StartUps\_1 = 3  
INFLOWS:  
Rate\_of\_Startups=  
IF(Investment\_in\_Projects>0)THEN(Investment\_Conversion\_to\_Startups/1500000)ELS  
E(0)  
OUTFLOWS:  
Buyouts = Total\_startups\*(0.05 - Fraction\_bought)  
Out\_of\_Business = Total\_startups\*(0.4 - Fraction\_broke)  
Steinbeck\_Funds(t)=Steinbeck\_Funds(t-dt)+(Cash\_Flow\_In\_1-  
Flow\_to\_Investment\_Fund-Flow\_to\_Research\_and\_Education-  
Operating\_Costs\_&\_Staff) \* dt  
INIT Steinbeck\_Funds = 5000000  
INFLOWS:  
Cash\_Flow\_In\_1 = (Grants\_for\_Research\_and\_Ops+Investment)\*percent\_allocated  
OUTFLOWS:  
Flow\_to\_Investment\_Fund = Steinbeck\_Funds\*Percentage\_Rate\_to\_I\_fund  
Flow\_to\_Research\_and\_Education = Steinbeck\_Funds\*Percentage\_Rate\_to\_R\_and\_E  
Operating\_Costs\_&\_Staff = Steinbeck\_Funds\*Percentage\_Rate\_to\_O\_and\_S  
Accelerator\_Stratups\_for\_Investment=(Entrepreneurs\*.20)/Commercial\_Applications\_fr  
om\_Proven\_Technologies  
CodorDojo\_and\_Other\_Students = Education\_and\_Training\_Dollars\_Spent/100  
Commercial\_Applications\_from\_Proven\_Technologies=DELAY1(Research\_Dollars\_Sp  
ent/500000,2)  
Entrepreneurs = Kaufman\_Graduates/5  
Fraction\_bought = IF (Total\_startups>0)THEN(Bought\_Out/Total\_startups)ELSE(0)  
Fraction\_broke = IF(Total\_startups>0)THEN (Failed\_Businesses/Total\_startups) ELSE  
(0)  
Grants\_for\_Research\_and\_Ops = GRAPH(TIME)  
(1.00, 2.9e+006), (2.00, 2.4e+006), (3.00, 2.1e+006), (4.00, 1.8e+006), (5.00, 965300),  
(6.00, 586751), (7.00, 217666), (8.00, 160883), (9.00, 132492), (10.0, 104101), (11.0,  
94637), (12.0, 85174), (13.0, 85174), (14.0, 85174), (15.0, 75710), (16.0, 66246), (17.0,

66246), (18.0, 66246), (19.0, 56782), (20.0, 56782), (21.0, 56782), (22.0, 56782), (23.0, 56782), (24.0, 56782), (25.0, 56782)



Investment = (Investors+(Return\_to\_Investeros\*.2)-(Out\_of\_Business\*1500000))  
Investment\_Conversion\_to\_Startups=  
(Shovel\_Ready\_Startups\_for\_Investment+Accelerator\_Stratups\_for\_Investment)\*150000  
0\*Tech\_labor\_pool\_effect\_on\_investment  
Investors = GRAPH(TIME)  
(1.00, 5.3e+006), (2.00, 5.8e+006), (3.00, 6.8e+006), (4.00, 7.9e+006), (5.00, 9.6e+006),  
(6.00, 1.1e+007), (7.00, 1.4e+007), (8.00, 1.6e+007), (9.00, 2e+007), (10.0, 2e+007),  
(11.0, 1.8e+007), (12.0, 1.6e+007), (13.0, 1.2e+007), (14.0, 5.7e+006), (15.0, 4.1e+006),  
(16.0, 3.1e+006), (17.0, 2.9e+006), (18.0, 2.8e+006), (19.0, 2.8e+006), (20.0, 2.8e+006),  
(21.0, 2.7e+006), (22.0, 2.7e+006), (23.0, 2.7e+006), (24.0, 2.7e+006), (25.0, 2.7e+006)



$$\text{Jobs} = (\text{StartUps\_1} * 200) + (\text{Bought\_Out} * 200)$$

$$\text{Kaufman\_Graduates} = \text{Education\_and\_Training\_Dollars\_Spent} / 1000$$

$$\text{New\_Start\_ups} = \text{StartUps\_1} + \text{Bought\_Out}$$

$$\text{Percentage\_Rate\_to\_I\_fund} = 0.7$$

$$\text{Percentage\_Rate\_to\_O\_and\_S} = 0.1$$

$$\text{Percentage\_Rate\_to\_R\_and\_E} = 0.2$$

$$\text{percent\_allocated} = 1$$

$$\text{Percent\_to\_CoderDojo\_and\_Other\_programs} = 0.05$$

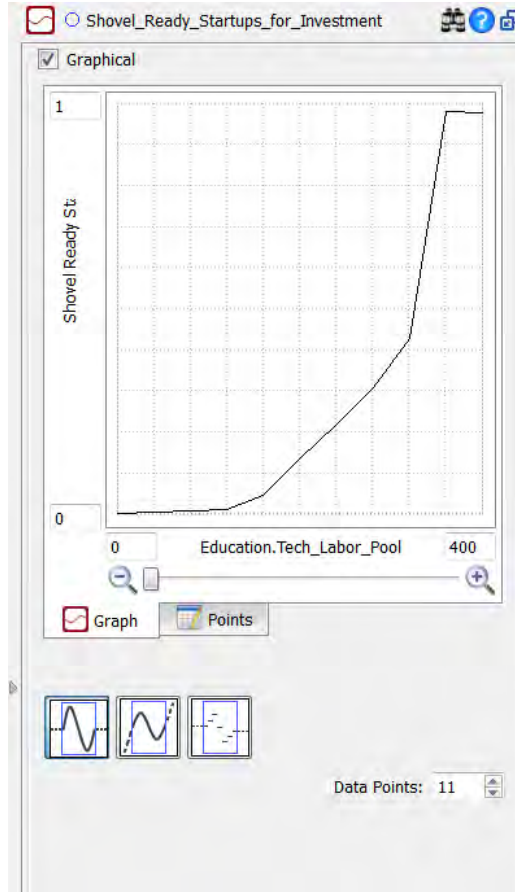
$$\text{Percent\_to\_Kauffman\_Training} = 0.1$$

$$\text{Percent\_to\_Research} = 0.85$$

$$\text{Return\_to\_Investors} = (\text{Buyouts} * (.15 * 2000000)) + (\text{StartUps\_1} * .15 * 1000000)$$

$$\text{Shovel\_Ready\_Startups\_for\_Investment} = \text{GRAPH}(\text{Education.Tech\_Labor\_Pool})$$

(0.00,	0.00315),	(40.0,	0.00631),	(80.0,	0.00946),	(120,	0.0126),	(160,	0.0473),	(200,	0.136),	(240,	0.221),	(280,	0.309),	(320,	0.429),	(360,	0.981),	(400,	0.978)
--------	-----------	--------	-----------	--------	-----------	-------	----------	-------	----------	-------	---------	-------	---------	-------	---------	-------	---------	-------	---------	-------	--------



Tech\_labor\_pool\_effect\_on\_investment = GRAPH(Education.Tech\_Labor\_Pool)  
 (0.00, 0.00), (36.4, 0.00), (72.7, 0.0126), (109, 0.0315), (145, 0.0379), (182, 0.0442),  
 (218, 0.142), (255, 0.322), (291, 0.467), (327, 0.659), (364, 0.874), (400, 0.991)

Total\_startups = Bought\_Out + Failed\_Businesses + StartUps\_1

### Ag-Tech Education

This module illustrates (Figure 2) the flow and feedback mechanisms among five stocks: High School (total students enrolled); General Higher Education (students enrolled); Ag Tech and VoEd Higher Education (students enrolled); Unemployed or Low Income (students leaving school without completing GED or pursuing higher education)); and, Ag Tech labor Pool (graduates of Ag Tech higher education).

The number of kids currently enrolled in High Schools was initialized at 9199 (actual figures from Salinas High School District for current year). The initialized number of kids registering was then estimated as 9199 / 4 or as a function of the

Population (currently 154,463),  $(0.0149 \times 154,463) = 2301$  (this figure is the population estimate for Salinas in 2012, the margin of error and the upper and lower bounds are 154,540 and 154,386; source: American Community Survey, American Fact Finder). The rate of increase for those Registering was estimated to be 0.87 percent (this figure is the mean of the year-to-year growth rate of Salinas Union High School from years 2000-1 to 2011-12; source: CA Department of Education), so the equation for estimating growth in registration for high school was  $(\text{Population} \times .0149) \times 1.0087$ . Initially this would result in an increased registration calculated as  $2301 \times 1.0087 = 2321$ . Registration increases as Population increases (input from another module).

The outflow from High School was a combination of the High School Drop Rate + those kids Leaving School after High School + those kids going on to Higher General Education (and Higher Ag Tech Education).

The number of kids going on to Higher Ag Tech Education was estimated based on those high school graduates matriculating to Ag programs at Hartnell college, and those high school graduates attending Fresno State, UC Davis, and Cal Poly (actual figures were provided by Salinas High School District).

High School Drop Rate was estimated to be 6.5 percent (this is the averaged drop-out rate in the district for the academic years between 2000-1 and 2011-12; source: California Department of Education.).

The High School Flow to Higher Education was a function of current percentage of graduates going on to higher education (noted as Higher = 0.3937) x the overall percentage of graduating seniors (17 percent of those enrolled in high school). (These estimates were computed based on actual numbers of graduating seniors and the number of seniors who went on to higher education last year, provided by Salinas High School District). So this initial number was  $0.3937 \times (0.17 \times 9199) = .3937 \times 1564 = 616$ . The percentage of graduating seniors going on to higher education was modeled to increase slightly to 0.400 over the course of the model's run (graphing function for Higher).

The annual flow to Unemployed or Low Income from High School was then estimated to be the  $(\text{Drop Rate} \times \text{High School} / 4) + ((1 - 0.3937) \times \text{High School} \times 0.17)$ . Initially this would have been  $(0.062 \times 9122/4) + ((1-0.3937) \times 9122 \times 0.17) = 141 + (0.6063 \times 1551) = 1081$ .

Of those High School graduates going on to Higher Education, a percentage of students choose to pursue Ag-Tech curricula. This group of students was modeled as being a subset of those high school kids who were exposed to Ag Tech Programs in High School. The percentage of those Interested in Ag Tech who choose to pursue Ag Tech was incentivized to increase by the Hiring Rate of Ag-Tech Graduates (a function of Ag Tech Jobs Available based on an input from another module and the Hiring Percentage).

The percentage of High School students with Access to Ag Tech Programs was estimated to be 17.7 percent of the High School population (based on current numbers of Salinas high school students enrolled in such programs throughout Salinas provided by Salinas High School District and computed per appropriate curricula). Currently, that number was rounded to be  $0.177 \times 9199 = 1628$  (actual figure is 1626). (General Ed higher education was arbitrarily initialized at 3,468 based on conservative current estimates).

To estimate the number of high school graduates who go on to Flow to Ag Tech and VoEd higher education per year, the equation was  $(\text{Access\_to\_Ag\_Tech\_Programs} \times 0.17) \times (\text{percentage of graduating seniors going on to higher agriculture education as a function of Hiring Rate})$ . Hiring Rate was a function of the Hiring Percentage Over Time (estimated to be 85 percent based on national figures for agriculture technology curricula that find employment within ten years of graduation) and the number of Ag Tech Jobs Available (a function of Job Growth input from another module). As the Hiring Rate increases from 40/yr to approximately 250/yr, the percentage of graduating seniors interested specifically in Ag Tech higher education was modeled to increase from 0.26 to 0.50 (graphing function Higer-Ag initialized with actual percentage of students enrolling in higher agriculture technology curricula provided by Salians High School District). Initially, the flow to Ag Tech was computed as  $(1628 \times 0.17) \times 0.26 = 277 \times 0.26 = 72$ . (Actual estimate for current year High School Graduates who went on to attend Hartnell,



Fresno State, Cal Poly, and UC Davis was 73, numbers provided by Salinas High School District). (AgTech and VoEd was initialized at 250, a cumulative total of those students enrolled per year for four year, 2.85 year, and one year programs taken from sources already cited).

The Graduation Rate from General Higher Education was estimated to be 67.1 percent (this figure was generated by using a combined graduation rate for California-based 4-year public and private universities within six years; source: Chronicle of Higher Education), so the Graduation Rate of the senior college class would be General Higher Ed/4 x 0.671.

The Graduation Rate from Ag Tech and VoEd was estimated to be 53.8 percent (this figure was generated by using a combined graduation rate for UC Davis, Cal Poly, CSU Fresno and Hartnell College within six years; source: Chronicle of Higher Education) but this was applied against a slightly shorter matriculation time (since VoEd programs are not generally four years long, 2.85 years was used as an estimate). The equation for Ag Tech and VoEd Graduation Rate was then (Ag Tech and VoEd / 2.85) x 0.538. The Ag Tech Labor Pool was initialized at 200 (rough initial estimate for those remaining in Labor Pool after graduation without employment).

The non-completion rates (Not Finishing General Higher Education, and Not Graduating Ag Tech) were simply all those who did not graduate as computed above.

The number of adults enrolling in Ag VoEd programs was incentivized by Ag Tech Jobs Available, which was, in turn, a function of Jobs (input from another module). It was estimated/assumed that 10 percent of new start-up jobs in the ag sector would appeal to skilled labor (versus college or university graduates), so that each year 10 percent of Ag Tech Jobs Available attracted Unemployed or Low Income workers to ag tech programs. The current enrollment figure for adults in ag tech VoEd was estimated to be 36 (this figure was calculated by aggregating the number of enrolled students over the age of 24 between the years 2009–12; source: California Community Colleges Chancellor's Office.), but as modeled, the Entering VoTech number increased significantly as Ag Tech Jobs Available increased over time.

The pool of Unemployed or Low Income is fed by those not completing High School or Higher Education plus those not pursuing or finishing Higher Education. The pool of Unemployed or Low Income is drained by those leaving the area (assumed to be approximately 10 percent of this pool), and those Entering AgTech VoEd to improve their employment/income status. The number of Unemployed or Low Income (earning less than \$25,000/yr) was initialized at 15,000, approximately 10 percent of the population (this figure is an average of the county-wide unemployment rate from 2003 to 2012; source: U.S. Bureau of Labor Statistics).

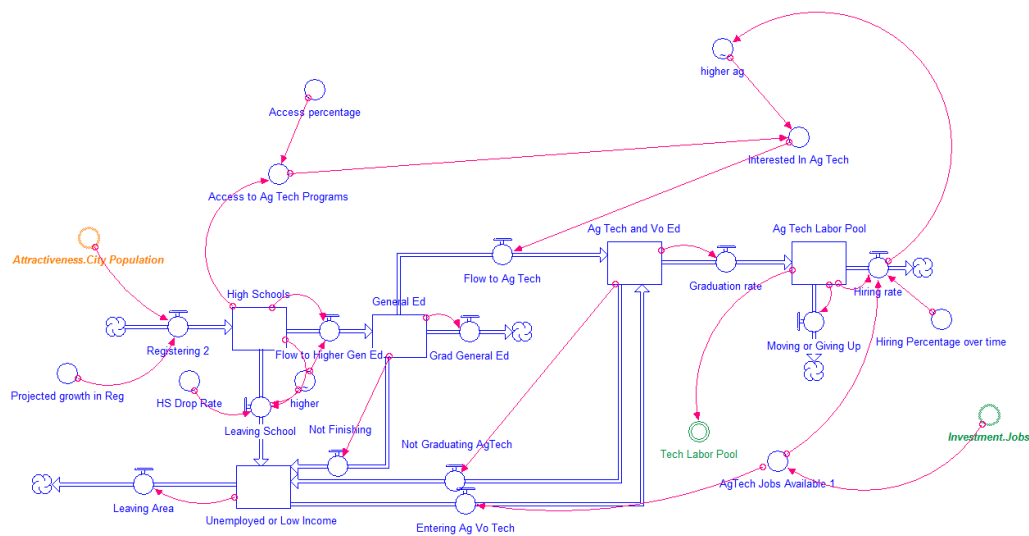


Figure 2. Education for Ag-Tech Employment

### Equations for Education and Ag-Tech Employment Module

$$\text{Ag\_Tech\_and\_Vo\_Ed}(t) = \text{Ag\_Tech\_and\_Vo\_Ed}(t - dt) + (\text{Entering\_Ag\_Vo\_Tech} + \text{Flow\_to\_Ag\_Tech} - \text{Not\_Graduating\_AgTech} - \text{Graduation\_rate}) * dt$$

INIT Ag\_Tech\_and\_Vo\_Ed = 250

INFLOWS:

$$\text{Entering\_Ag\_Vo\_Tech} = \text{AgTech\_Jobs\_Available\_1} * .10$$

$$\text{Flow\_to\_Ag\_Tech} = \text{Interested\_In\_Ag\_Tech}$$

OUTFLOWS:

$$\text{Not\_Graduating\_AgTech} = (\text{Ag\_Tech\_and\_Vo\_Ed}/4) * (1-.538)$$

$$\text{Graduation\_rate} = (\text{Ag\_Tech\_and\_Vo\_Ed}/2.85) * .538$$

$$\text{Ag\_Tech\_Labor\_Pool}(t) = \text{Ag\_Tech\_Labor\_Pool}(t - dt) + (\text{Graduation\_rate} - \text{Hiring\_rate} - \text{Moving\_or\_Giving\_Up}) * dt$$

INIT Ag\_Tech\_Labor\_Pool = 200

INFLOWS:

Graduation\_rate = (Ag\_Tech\_and\_Vo\_Ed/2.85)\*.538

OUTFLOWS:

Hiring\_rate=IF(Ag\_Tech\_Labor\_Pool/4>AgTech\_Jobs\_Available\_1)THEN(AgTech\_Jobs\_Available\_1\*Hiring\_Percentage\_over\_time)ELSE(Ag\_Tech\_Labor\_Pool/4)

Moving\_or\_Giving\_Up = Ag\_Tech\_Labor\_Pool\*.10

General\_Ed(t) = General\_Ed(t - dt) + (Flow\_to\_Higher\_Gen\_Ed - Not\_Finishing - Flow\_to\_Ag\_Tech - Grad\_General\_Ed) \* dt

INIT General\_Ed = 3468

INFLOWS:

Flow\_to\_Higher\_Gen\_Ed = (High\_Schools\*.17)\*higher

OUTFLOWS:

Not\_Finishing = (General\_Ed/4)\*(1-.671)

Flow\_to\_Ag\_Tech = Interested\_In\_Ag\_Tech

Grad\_General\_Ed = (General\_Ed/4)\*.671

High\_Schools(t) = High\_Schools(t - dt) + (Registering\_2 - Leaving\_School - Flow\_to\_Higher\_Gen\_Ed) \* dt

INIT High\_Schools = 9199

INFLOWS:

Registering\_2 = (Attractiveness.City\_Population\*.0149)\*Projected\_growth\_in\_Reg

OUTFLOWS:

Leaving\_School = (High\_Schools\*HS\_Drop\_Rate/4)+((1-higher)\*High\_Schools\*.17)

Flow\_to\_Higher\_Gen\_Ed = (High\_Schools\*.17)\*higher

Unemployed\_or\_Low\_Income(t) = Unemployed\_or\_Low\_Income(t - dt) + (Not\_Graduating\_AgTech + Not\_Finishing + Leaving\_School - Leaving\_Area - Entering\_Ag\_Vo\_Tech) \* dt

INIT Unemployed\_or\_Low\_Income = 15000

INFLOWS:

Not\_Graduating\_AgTech = (Ag\_Tech\_and\_Vo\_Ed/4)\*(1-.538)

Not\_Finishing = (General\_Ed/4)\*(1-.671)

Leaving\_School = (High\_Schools\*HS\_Drop\_Rate/4)+((1-higher)\*High\_Schools\*.17)

OUTFLOWS:

Leaving\_Area = Unemployed\_or\_Low\_Income\*.10

Entering\_Ag\_Vo\_Tech = AgTech\_Jobs\_Available\_1\*.10

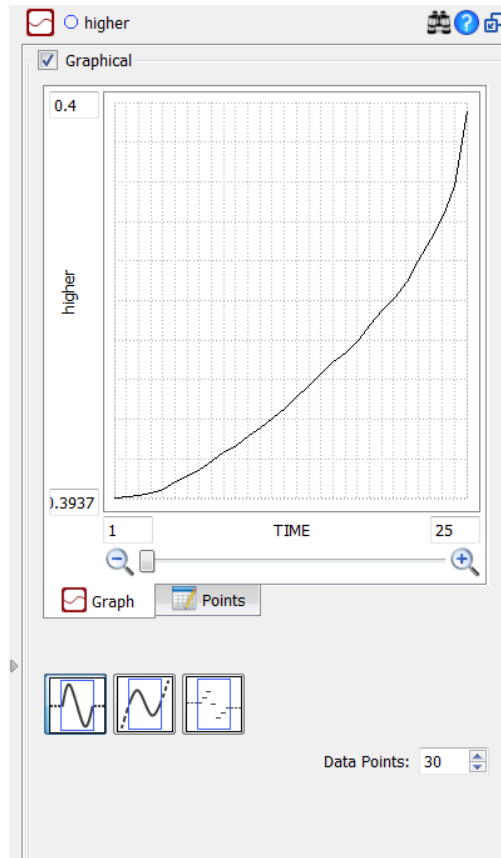
Access\_percentage = 0.177

Access\_to\_Ag\_Tech\_Programs = High\_Schools\*Access\_percentage

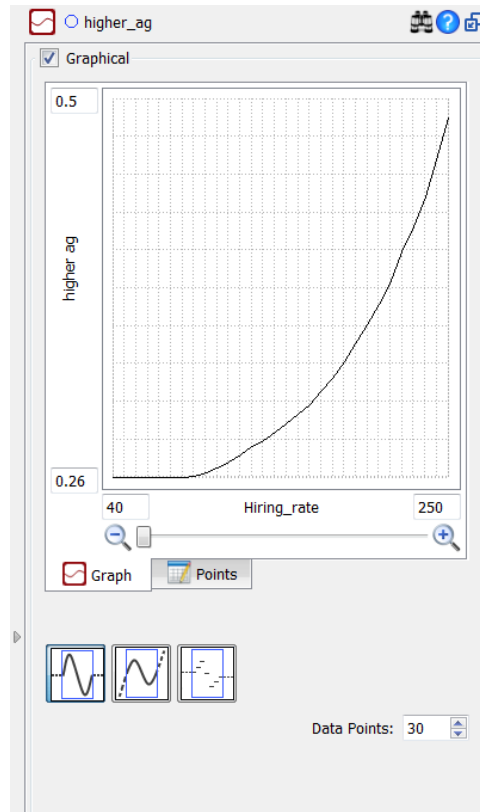
AgTech\_Jobs\_Available\_1 = Investment.Jobs

higher = GRAPH(TIME)

(1.00, 0.394), (1.83, 0.394), (2.66, 0.394), (3.48, 0.394), (4.31, 0.394), (5.14, 0.394), (5.97, 0.394), (6.79, 0.394), (7.62, 0.394), (8.45, 0.394), (9.28, 0.395), (10.1, 0.395), (10.9, 0.395), (11.8, 0.395), (12.6, 0.395), (13.4, 0.395), (14.2, 0.396), (15.1, 0.396), (15.9, 0.396), (16.7, 0.396), (17.6, 0.396), (18.4, 0.396), (19.2, 0.397), (20.0, 0.397), (20.9, 0.397), (21.7, 0.397), (22.5, 0.398), (23.3, 0.398), (24.2, 0.399), (25.0, 0.4)



```
higher_ag = GRAPH(Hiring_rate)
(40.0, 0.26), (47.2, 0.26), (54.5, 0.26), (61.7, 0.26), (69.0, 0.26), (76.2, 0.26), (83.4, 0.26),
(90.7, 0.261), (97.9, 0.263), (105, 0.266), (112, 0.27), (120, 0.274), (127, 0.28), (134,
0.283), (141, 0.289), (149, 0.294), (156, 0.3), (163, 0.306), (170, 0.315), (178, 0.323),
(185, 0.333), (192, 0.345), (199, 0.357), (207, 0.37), (214, 0.385), (221, 0.403), (228,
0.419), (236, 0.438), (243, 0.461), (250, 0.488)
```



Hiring\_Percentage\_over\_time = 0.85

HS\_Drop\_Rate = 0.065

Interested\_In\_Ag\_Tech = (Access\_to\_Ag\_Tech\_Programs\*.17)\*(higher\_ag)

Projected\_growth\_in\_Reg = 1.0087

Tech\_Labor\_Pool = Ag\_Tech\_Labor\_Pool

## Gang Membership

The Gang Membership Module (Figure 3) is based upon a susceptibility/infectivity (S/I), disease diffusion logistics model.

The pool of susceptibles (those susceptible to becoming infected with gang membership) is comprised of the Salinas population of individuals aged 15–24 years.

The pool of infected Gang Members consists of criminally active gang members aged 15 to 35 years.

The rate of flow from the Fifteen to Twenty Four Yr Olds pool to the Gang Member pool is a mathematic function of the Contact Rate (percent of Fifteen to Twenty Four Yr Olds in regular contact with Gang Members), Infectivity (the probability of

becoming a gang member as a result of regular contact), the size of the Fifteen to Twenty Four Yr Olds (susceptible) pool and the size of the Gang Members (infected) pool. Infectivity is diminished by Jobs growth (input from another module) via the Impact on Infectivity connector. Infectivity was based on best estimates of the Salinas Police Chief and is modeled as a graphing function that decreases as job opportunity increases, again per estimates of the Police Chief).

For purposes of modeling the strategy and based upon conversation with local STEM interns from gang-influenced families in East Salinas, it was estimated that 8—13 year old kids exposed to Coder Dojo or other STEM programs would be STEM Inoculated against Gang Membership upon reaching the age of 15 (and would be subtracted from the Fifteen to Twenty Four Yr Olds—susceptible-pool).

The number of Fifteen to Twenty Four Yr Olds was initialized at 25,004 (the average number of people aged 15–24 from the 2000 Census, the 2010 Census and the 2005–12 American Community Survey).

The anticipated annual growth rate of Fifteen to Twenty Four Yr Olds (those reaching 15 years of age) is  $1.02 \times \text{Population}$  (input from another module) minus the flow of 8-13 year old kids exposed to Coder Dojo and Other STEM programs (input from another module) who reach the age of 15. Of note, the number of kids exposed to Coder Dojo and Other STEM programs tapers off after year 10 when funding for those programs is reduced, which results in a rebound in the number of Fifteen to Twenty Four Yr Olds over time. (The anticipated increase in population of 15 to 24 year olds was based upon calculations that took the mean of the percentages given for those aged 15-24 by the 2000 and 2010 censuses; source: U.S. Census Bureau, ACS. That percentage was applied to the overall population figures and the growth rate was projected to be 2 percent, which was agreed by Salinas City Manager's office to be more than the slightly negative growth rate calculated by census data).

The total outflow from Fifteen to Twenty Four Yr Olds is the number of adults reaching 25 Years of Age Gang Free plus those becoming Gang Members.

Gang Members was initialized at 800 (based on figures of current criminally active gang members provided by the Salinas Police Department).

The outflow from Gang Members is a sum of the Permanent Removal Rate (through long term—felony—incarceration or Gang on Gang homicide) and the Reform and Retirement Rate (those Gang Members reaching 35 years of age and those finding employment through reform). (Number of retired per year was estimated to be 5 percent and those gang members who find employment was estimated as 40 percent of those gang members enrolled in community work programs based on agreed figures with Salinas Police Chief).

The Police Gang Arrests (homicides only, resulting in conviction for long term incarceration) are a function of Gang on Gang Homicides x Police Capacity / Gang Members. Initialized as  $21 \times 145/800 = 3.8/\text{yr}$ . (Estimates based on agreed figures with Salinas Police Chief).

Police Capacity increases as city Revenue increases based on an input from another module, and is capped at 320. (Assumption based on agreed figures with Salinas Police Chief).

Gang Homicides is a function of the number of Gang Members.

Violent Crimes total is a function of Gang Members and non-gang-members in the Population based on statistics related to the number of crimes per year attributed to Gang Members and those crimes not attributed to Gang Members. This was initialized as  $(\text{Gang Homicides} \times 1.12) + ((\text{Gang members} \times .21) + (\text{Population} \times .0055)) = (20 \times 1.12) + (800 \times .21) + (154,463 \times .0055) = (22) + (168) + (850) = 1040$ . The number of total violent crimes is diminished as Police Capacity increases (input from another module). (Number of violent crimes per year was computed based upon current year data as a function of gang member and non-gang member populations. Projected violent crime figures were then calculated by applying the percentage of non-homicide, NON-gang-related felonies, from three selected police reporting districts, to the overall number of felony crimes committed in Salinas in 2012; source: Salinas Police Department & FBI Uniform Crime. Estimated total violent and significant property crimes per capita per

year was calculated by taking the average level of violent and property crime per capita between the years of 2005-2012; source Federal Bureau of Investigation. Number of homicides per year was computed from data provided by Salinas Police Department.)

Population increases as the number of High Income Earners who in-migrate increases (input from another module).

The number of Gang Members Enrolled in Community Work Programs is a function of the Funds for VoEd Reform and the Percent of Members Enrolled in Work Programs. Funds for VoEd Reform are, in turn, modeled as a function of the number of gang homicides per year. As Gang on Gang Homicides decrease below 16 per year, the amount of funding is slashed from an initialized (and arbitrarily determined) average of \$500,000/yr to \$200,000/yr, thereby reducing the Percent Members Enrolled in Work Programs from 12 percent to approximately 5 percent of Gang Members. So initially, gang members Enrolled in Community Work Programs was  $.12 \times 800 = 96$ . This number diminishes as the number of Gang Members diminish, causing the number of Gang Homicides/yr to diminish from 20/yr to less than 16/yr. (These figures are estimates only, based upon assumed funds provided for work programs and estimates for current enrollment agreed upon with Salinas Police Chief).

Employment (of Gang Members in Work Programs) is a function of the number of gang members Enrolled in Community Work Programs and was estimated to be 40 percent of those enrolled gaining employment. So initially this was estimated to be  $.40 \times 96 = 38$ .

The Reform and Retirement Rate was then initially  $\text{Employment} + \text{those Gang Members who turn 35 per year}$  ( $\text{Gang Members} \times .05$ )  $= 38 + 40 = 78/\text{yr}$ .



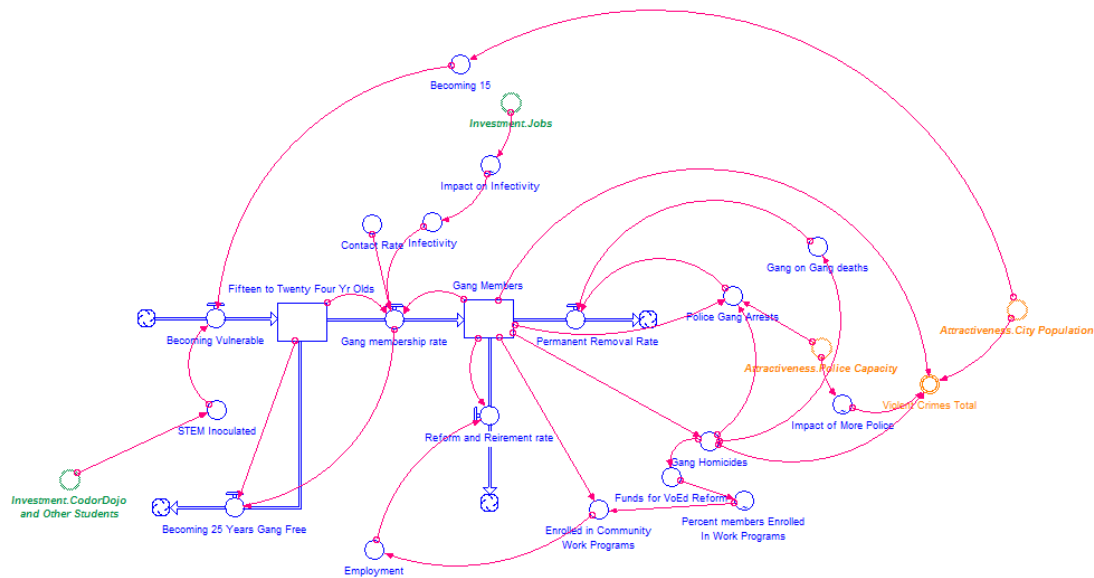


Figure 3. Gang Membership and Programs

### Equations for Gang Membership and Programs Module

$\text{Fifteen\_to\_Twenty\_Four\_Yr\_Olds}(t) = \text{Fifteen\_to\_Twenty\_Four\_Yr\_Olds}(t - dt) + (\text{Becoming\_Vulnerable} - \text{Gang\_membership\_rate} - \text{Becoming\_25\_Years\_Gang\_Free}) * dt$

INIT Fifteen\_to\_Twenty\_Four\_Yr\_Olds = 25004

INFLOWS:

$\text{Becoming\_Vulnerable} = \text{Becoming\_15} - \text{STEM\_Inoculated}$

OUTFLOWS:

$\text{Gang\_membership\_rate} =$

IF( $\text{Gang\_Members} > 0$ ) THEN ( $\text{Contact\_Rate} * \text{Infectivity} * \text{Fifteen\_to\_Twenty\_Four\_Yr\_Olds}$ ) \* (( $\text{Gang\_Members}$ ) / ( $\text{Gang\_Members} + \text{Fifteen\_to\_Twenty\_Four\_Yr\_Olds}$ )) ELSE (0)

$\text{Becoming\_25\_Years\_Gang\_Free} = ((\text{Fifteen\_to\_Twenty\_Four\_Yr\_Olds} / 8) * 1.01) - \text{Gang\_membership\_rate}$

$\text{Gang\_Members}(t) = \text{Gang\_Members}(t - dt) + (\text{Gang\_membership\_rate} - \text{Permanent\_Removal\_Rate} - \text{Reform\_and\_Reirement\_rate}) * dt$

INIT Gang\_Members = 800

INFLOWS:

$\text{Gang\_membership\_rate} =$

IF( $\text{Gang\_Members} > 0$ ) THEN ( $\text{Contact\_Rate} * \text{Infectivity} * \text{Fifteen\_to\_Twenty\_Four\_Yr\_Olds}$ ) \* (( $\text{Gang\_Members}$ ) / ( $\text{Gang\_Members} + \text{Fifteen\_to\_Twenty\_Four\_Yr\_Olds}$ )) ELSE (0)

OUTFLOWS:

$\text{Permanent\_Removal\_Rate} = \text{Police\_Gang\_Arrests} + \text{Gang\_on\_Gang\_deaths}$

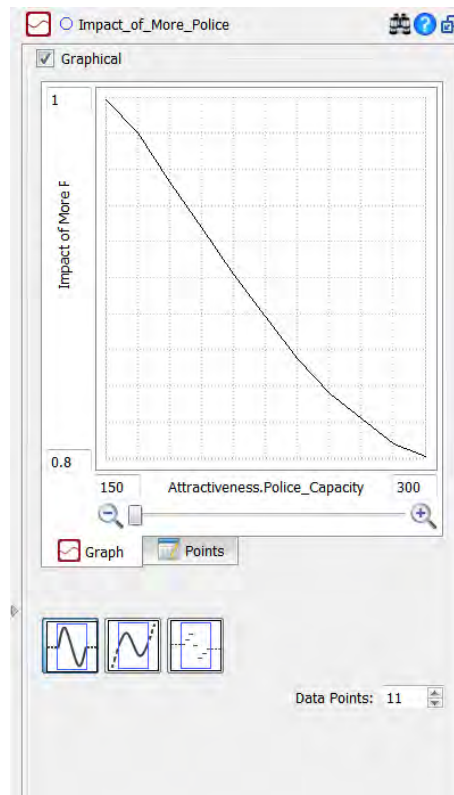
$\text{Reform\_and\_Reirement\_rate} = \text{Employment} + (\text{Gang\_Members} * .05)$

$\text{Becoming\_15} = \text{Atractiveness.City\_Population} * .02$

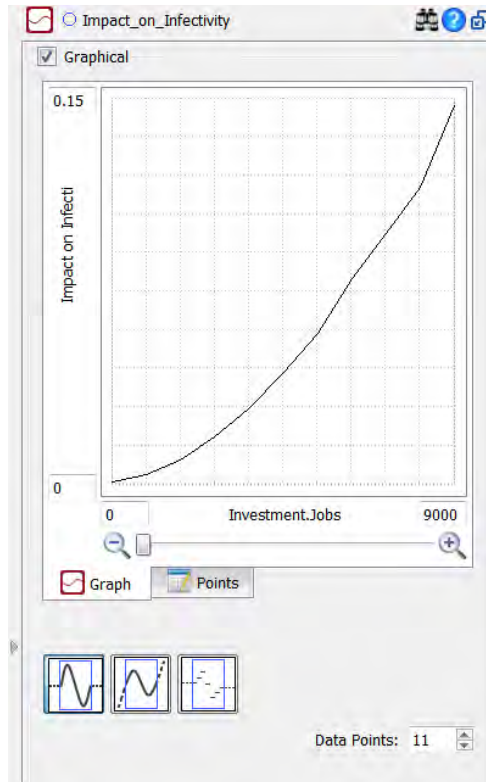
$\text{Contact\_Rate} = 0.3$

$\text{Employment} = (\text{Enrolled\_in\_Community\_Work\_Programs}) * .40$

Enrolled\_in\_Community\_Work\_Programs=  
 IF(Gang\_Members>0)THEN(Percent\_members\_Enrolled\_In\_Work\_Programs\*Gang\_M  
 embers)ELSE(0)  
 Funds\_for\_VoEd\_Reform=  
 IF(Gang\_Homicides>15)THEN(NORMAL(500000,50000,500000))ELSE(200000)  
 Gang\_Homicides = Gang\_Members\*.025  
 Gang\_on\_Gang\_deaths = Gang\_Homicides\*.6  
 Impact\_of\_More\_Police = GRAPH(Attractiveness.Police\_Capacity)  
 (150, 0.999), (165, 0.98), (180, 0.953), (195, 0.928), (210, 0.902), (225, 0.879), (240,  
 0.855), (255, 0.836), (270, 0.822), (285, 0.808), (300, 0.801)

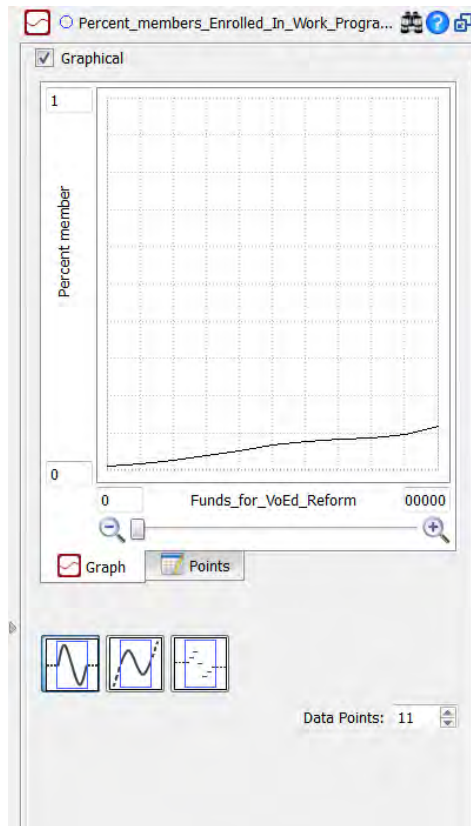


Impact\_on\_Infectivity = GRAPH(Investment.Jobs)  
 (0.00, 0.000946), (900, 0.00379), (1800, 0.00946), (2700, 0.0185), (3600, 0.0293), (4500,  
 0.0431), (5400, 0.0587), (6300, 0.08), (7200, 0.0975), (8100, 0.115), (9000, 0.147)



Infectivity = 0.3-(Impact\_on\_Infectivity)

Percent\_members\_Enrolled\_In\_Work\_Programs = GRAPH(Funds\_for\_VoEd\_Reform)  
 (0.00, 0.0126), (50000, 0.0189), (100000, 0.0284), (150000, 0.041), (200000, 0.0536),  
 (250000, 0.0694), (300000, 0.0789), (350000, 0.0852), (400000, 0.0883), (450000,  
 0.0978), (500000, 0.12)



```

Police_Gang_Arrests=
IF(Gang_Homicides>0)THEN(Gang_Homicides*(Attractiveness.Police_Capacity/Gang_
Members))ELSE(0)
STEM_Inoculated = STEP(Investment.CodorDojo_and_Other_Students,3)
Violent_Crimes_Total=
(((Gang_Homicides*1.12)+((Gang_Members*.21)+(Attractiveness.City_Population*.005
5))))*Impact_of_More_Police

```

## Water Management

All Monterey County Water is supplied from within the County, largely through groundwater aquifers and some surface water capture. The aquifers and dams are replenished through annual rainfall. The Water Management Module (Figure 4) features two stocks only: Groundwater and Surface Water; and, Water to be Recycled. There are three primary demands placed on the water supply: Agriculture (initialized as 90 percent of all demand); Residential (initialized as 7 percent); and, Commercial (initialized as 3 percent). (All data used in the Water Management module was based upon data provided by the Monterey County Water Resource Agency and their team of hydrologists, and estimates of projected use and replenishments were agreed upon by County hydrologists).

Current Groundwater and Surface Water volume was initialized at 1,500,000 ac/ft.

The Rate of Supply is a function of annual Rainfall Replenishment Rate—Runoff (of rainfall that does not percolate into the aquifer).

Annual Rainfall was based upon an average rainfall in Monterey County from 2005—2012 and was modeled as a Normal distribution with a Mean of 2,503,464 ac/ft, a Standard Deviation of 258,842 ac/ft, and a period of 25 years).

Runoff was estimated to be 70 percent.

Rate of Supply was then calculated to be 30 percent of annual Rainfall.

Groundwater and Surface Water is drained by the Agriculture, Commercial, and Residential Demand plus Water Loss that is attributable to Evaporation Rate (1 percent), Annual Surface Water Outflow & Loss to Contamination (15 percent), and Saltwater Intrusion Rate (0.1 percent); Saltwater Intrusion Rate is modeled to increase as the volume of the Groundwater and Surface Water diminishes over the run of the model.

Groundwater and Surface Water also receives some replenishment from irrigation water that percolates back into the aquifers after use. That Water to Aquifer rate was estimated to be 35 percent of water available from the Water to be Recycled pool.

The Water to be Recycled pool was drained by urban water that is recycled annually (estimated to be 12,232 ac/ft) that goes directly to satisfy Agriculture Demand; by water that is lost to Evapotranspiration or Absorbed by Crops (estimated to be 90 percent of water used by Ag, Residential and Commercial); and, by Water to Aquifer that percolates back into groundwater supply (as noted above).

Water to be Recycled was initialized at 540,000 ac/ft. So initial Water to Aquifer rate was computed as  $(\text{Water to be Recycled}) - ((\text{Water to be Recycled} \times 0.90) - \text{Reclamation}) \times 0.35 = (540,000 - ((540,000 \times 0.90) - 12,232) \times 0.35) = (540,000 - (486,000 - 12,232)) \times .35 = 18,900 \text{ ac/ft.}$

Water Available for Use is a function of Groundwater and Surface Water x Specific Yield rate + Desalination input (estimated to be 240 ac ft/ yr) .

Specific Yield Rate was estimated to be 0.35, so Water Available for use was initially estimated to be  $.35 \times 1,500,000 \text{ ac/ft} = 525,000 \text{ ac/ft}$ . [Agriculture receives an additional 12, 232 ac ft from Reclamation as noted above]. Specific Yield Rate was modeled to be increased to 39 percent by a policy decision that would be forced around year 19 to accommodate increased demand from increasing Area Attractiveness and growth.

Agriculture Demand is affected by the demands from Commercial and Residential use and is augmented by Reclamation water. Agriculture Demand was calculated to be  $\text{Reclamation} + (\text{Water\_Available\_for\_Use} * (1.00 - (\text{Residential\_}\% + \text{Comm\_}\%)))$ . Residential Demand was initialized at 0.07 and Commercial Demand was initialized at 0.03. Residential Demand/Usage was modeled to increase as a function of increasing High Income in-migrants (input from another module), and Commercial Demand/Usage was modeled to increase as a function of New Business Start-ups (input from another module), thereby somewhat diminishing Agriculture Demand/Usage over the run of the model.

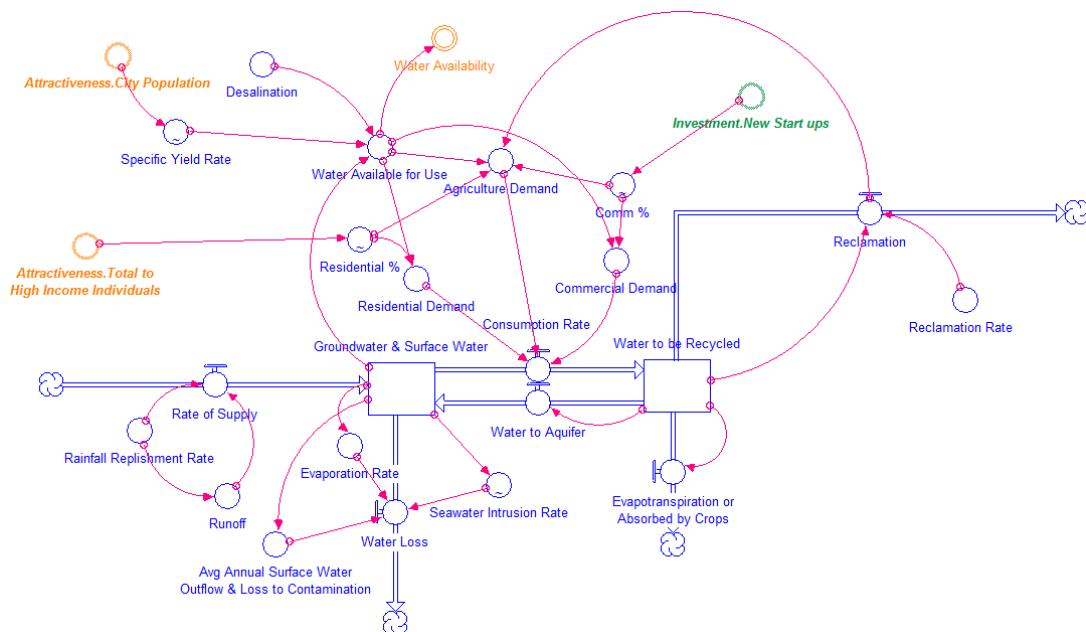


Figure 4. Water Management

### Equations for Water Management Module

Groundwater\_&\_Surface\_Water(t) = Groundwater\_&\_Surface\_Water(t - dt) + (Rate\_of\_Supply + Water\_to\_Aquifer - Consumption\_Rate - Water\_Loss) \* dt

INIT Groundwater\_&\_Surface\_Water = 1500000

INFLOWS:

Rate\_of\_Supply =

(Rainfall\_Replishment\_Rate)-(Runoff)

Water\_to\_Aquifer = Water\_to\_be\_Recycled\*.35

OUTFLOWS:

Consumption\_Rate= Agriculture\_Demand+Commercial\_Demand+Residential\_Demand)

Water\_Loss=

Evaporation\_Rate+Avg\_Annual\_Surface\_Water\_Outflow\_&\_Loss\_to\_Contamination+S  
eawater\_Intrusion\_Rate

Water\_to\_be\_Recycled(t) = Water\_to\_be\_Recycled(t - dt) + (Consumption\_Rate -  
Water\_to\_Aquifer - Reclamation - Evapotranspiration\_or\_Absorbed\_by\_Crops) \* dt

INIT Water\_to\_be\_Recycled = 540000

INFLOWS:

Consumption\_Rate=(Agriculture\_Demand+Commercial\_Demand+Residential\_Demand)

OUTFLOWS:

Water\_to\_Aquifer = Water\_to\_be\_Recycled\*.35

Reclamation=

IF(Water\_to\_be\_Recycled>Reclamation\_Rate)THEN(Reclamation\_Rate)ELSE(0)

Evapotranspiration\_or\_Absorbed\_by\_Crops = Water\_to\_be\_Recycled\*.90

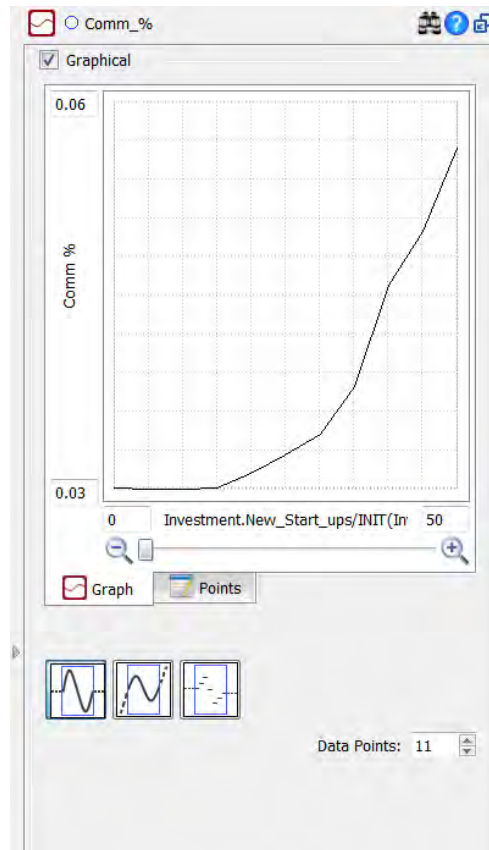
Agriculture\_Demand=Reclamation+(Water\_Available\_for\_Use\*(1.00-  
(Residential\_%+Comm\_%)))

Avg\_Annual\_Surface\_Water\_Outflow\_&\_Loss\_to\_Contamination=0.15\*Groundwater\_  
&\_Surface\_Water

Commercial\_Demand = Comm\_%\*Water\_Available\_for\_Use

Comm\_% = GRAPH(Investment.New\_Start\_ups/INIT(Investment.New\_Start\_ups))

(0.00, 0.0301), (5.00, 0.03), (10.0, 0.03), (15.0, 0.0301), (20.0, 0.0312), (25.0, 0.0326),  
(30.0, 0.0343), (35.0, 0.0379), (40.0, 0.0458), (45.0, 0.05), (50.0, 0.0564)



Desalination = 240

Evaporation\_Rate = 0.1\*Groundwater\_&\_Surface\_Water

Rainfall\_Replishment\_Rate = NORMAL(2503464,258842,25)

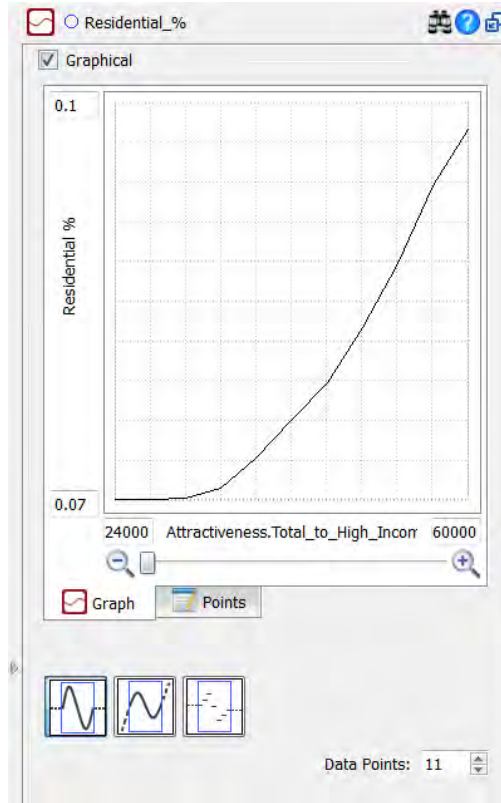
Reclamation\_Rate = 12232

Residential\_%=

GRAPH(Attractiveness.Total\_to\_High\_Income\_Individuals/INIT(Attractiveness.Total\_to\_High\_Income\_Individuals))

(24000, 0.0701), (27600, 0.0701), (31200, 0.0702), (34800, 0.0709), (38400, 0.0732), (42000, 0.0761), (45600, 0.0789), (49200, 0.0831), (52800, 0.0879), (56400, 0.0938), (60000, 0.098)





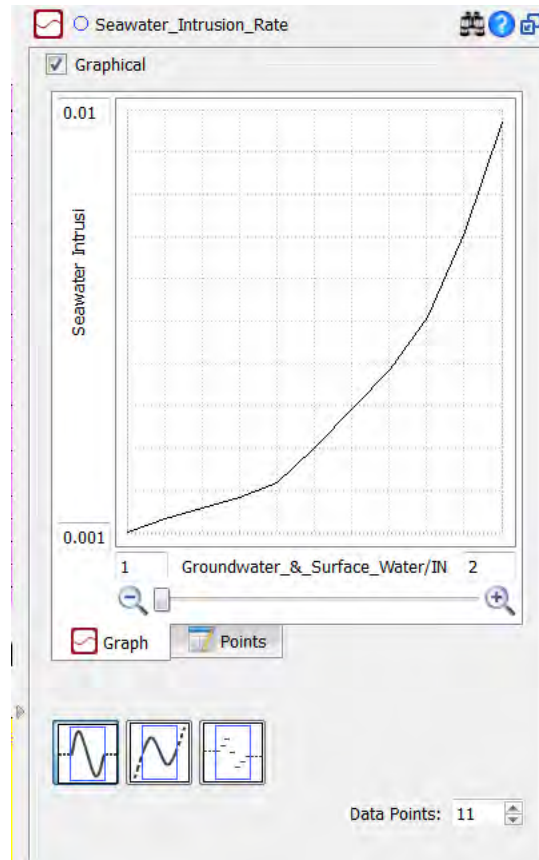
$\text{Residential\_Demand} = \text{Residential\_}\% \times \text{Water\_Available\_for\_Use}$

$\text{Runoff} = (\text{Rainfall\_Replishment\_Rate} \times .70)$

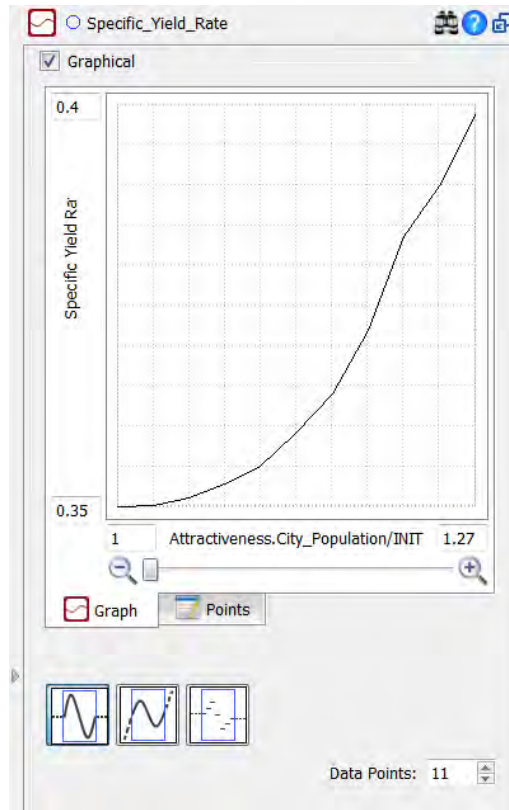
$\text{Seawater\_Intrusion\_Rate} =$

$\text{GRAPH}(\text{Groundwater\_}\&\_ \text{Surface\_Water} / \text{INIT}(\text{Groundwater\_}\&\_ \text{Surface\_Water}))$

(1.00, 0.00103), (1.10, 0.00131), (1.20, 0.00154), (1.30, 0.00177), (1.40, 0.00208), (1.50, 0.00282), (1.60, 0.00367), (1.70, 0.00449), (1.80, 0.0056), (1.90, 0.00742), (2.00, 0.00974)



Specific\_Yield\_Rate=  
 GRAPH(Attractiveness.City\_Population/INIT(Attractiveness.City\_Population))  
 (1.00, 0.35), (1.03, 0.35), (1.05, 0.351), (1.08, 0.353), (1.11, 0.355), (1.14, 0.359), (1.16,  
 0.364), (1.19, 0.372), (1.22, 0.384), (1.24, 0.39), (1.27, 0.399)



$\text{Water\_Availability} = \text{Water\_Available\_for\_Use}$   
 $\text{Water\_Available\_for\_Use} = (\text{Groundwater\_}\&\_\text{Surface\_Water} * \text{Specific\_Yield\_Rate}) + \text{Desalination}$

### **In-Flow of High Income Earners, Area Attractiveness**

The Area Attractiveness Module (Figure 5) is intended to measure the in-flow of High Income Earners (\$75K/yr) into Salinas from a pool of potential in-migrants from five nearby cities. Since the focus of this model is on attracting high-tech agriculture industry engineers and designers (Potential Movers), the five cities chosen were San Jose, Santa Clara, Morgan Hill, Walnut Creek, and Milpitas. It was estimated that each year, a pool of 4,000 possible in-migrants from these cities combined, was initially available for “attraction” to Salinas (that figure increases over the run of the model as a graphing function). (Estimates for pool of potential movers was based upon assumptions and gross estimates of agriculture technology-related professionals living in the the communities identified).

Area Attractiveness was determined by comparing six factors, weighting each factor, and multiplying that by a competitiveness ratio (Salinas factor score / average score among the five). The scoring was based upon <http://www.areavibes.com/methodology/> city by city comparisons in five of the six factor areas (water availability was not included in this). AreaVibes scores (on an A—F grading scale) were based upon data obtained from the U.S. Census Bureau, Google Places, FBI Uniform Crime Reports, Council for Community and Economic Research, U.S. Environmental Protection Agency, and the National Weather Service. For purposes of the model, the A—F ordinal grades were made numeric on a 4—0 scale. Thus, a score of A received a numeric ranking of 4, a score of F received a numeric ranking of 0. To avoid a divide by zero error in creating the ratio of Salinas / City Avg for the Cost of Living factor, I converted the average score of F (or 0) for the five cities, to a 0.5 so that dividing by 0.5 gave Salinas twice its nominal weighted factor score, since Salinas does NOT have a score of F / 0 for Cost of Living, and this is a significant factor of attractiveness. On the other hand, because Salinas did receive a score of F / 0 for education, I left that as a ratio that equals 0 until such time as Salinas receives a score higher than 0 (modeled to be approximately 8 years). In some cases, the change of factor score was a function of the change in input ratio over time (e.g., Salinas Community Security increased from a factor of 1 to 3 as the ratio of Violent Crimes to Population (input from another module) decreased over a 25 year period as a result of diminishing violent crime that was attributed to increased police capacity and a reduction in the Gang Member population). (Details of the sources used by AreaVibes to compute city scores is provided below).

The six factors that contributed to the overall Area Attractiveness Score were: Community Security; Quality of Schools; Quality of Service; Employment; Cost of Living; and, Water Availability (seen as largely binary: either sufficient or insufficient, slightly diminishing from a Factor score of 1.0 to a fraction of 1.0 over time as commercial and residential demand increases, input from another module). Each factor was given a weight from 0.5—3.5 (factors and factor-weightings were agreed upon with the Salinas City Manager's office), with factors summing to 10). Factors were weighted as follows:

Community Security = 3.5

Employment = 2.0

Cost of Living = 2.0

Quality of Schools = 1.0

Quality of Service = 1.0

Water Availability = 0.5

Total Area Attractiveness Score was structured as a PI function, with each factor weight multiplied by its AreaVibes scoring ratio (Salinas / Cities Avg), then multiplied together for a total score. That multiplicative total was normalized by dividing by 7 (the PI function of all weighted factor maximums). The total potential population of Potential Movers (4,000) was then multiplied by this Normalized Score to arrive at an annual inflow of High Earners. Of note, since the Area Attractiveness Score is a PI function, the score is zeroed out by any one factor receiving a score of 0, as was the case in Salinas Quality of Schools until approximately year nine of the model's run. (Factor scores for each of the six factors changed over time as estimated by graphing functions based upon changes in initial scores that resulted from model inputs such as increased city revenue per capita, violent crimes per capita, increased quality of schools, proportion of middle to high income earners per population, water availability, and jobs creation). (Estimates for changes in scores for each of the six factors were agreed upon by the City Manager's office).

City Population was initialized at 154,463. City Population increases as the number of High Income Earner in-migrants increases. This was in addition to the County's projection that the local population would grow at an annual rate of 0.55 percent. (The growth rate was calculated in two steps. First, the population levels provided by the American Community Survey between 2005 and 2012 were used to produce a growth rate. Second, the growth rates during this time period were averaged to create a singular growth rate; source: American Community Survey and American Fact Finder, AFF. This figure, negative 0.11 percent, was modified by the Salinas City

Manager's office to be 0.55 percent at the request of the Salinas City Manager's office). (Projected growth was captured by a graphing function).

As the ratio of High Income Earners / City Population *increases*, the Cost of Living Factor *decreases* over the 25 year run of the model.

Middle to High Income Earners was initialized at 15 percent of the total population, or 23,169 (this percentage was calculated by taking the population information bundled by household and income level and isolating households with incomes \$100,000 or higher per year between 2005 and 2012. Those percentages of the population were averaged to produce a number close to the trend line; source: U.S. Census Bureau, American Community Survey. No individual-level data was available).

Expected annual internal growth of Middle to High Income Earners was estimated to be half of one percent of total Middle to High Income Earners (initialized at 1.005 x 24,096, or 120). (Estimate was agreed upon by the City Manager's office).

Leaving Rate was calculated as the sum of the adjusted death rate in the 25-64 year old age range plus the anticipated emigration rate in the same age range (for Monterey Co), or 0.79 percent. (This figure was calculated by combining the death for 25 to 64-year olds with the rate of emigration, which was adjusted assuming the same portion of the population that is 24 to 64 is the same as that of the emigrating population; source: American Community Survey, County-to-County Flow Mapper and US Center for Disease Control).

City Revenue (General fund) was initialized as \$77,257,166 (based on recent year to year average provided by City of Salinas).

The revenue base was determined to be 35 percent of total Revenue, or initialized at \$27,040,008 with an anticipated annual growth rate of 2.7 percent (approximately \$45M after 25 years). (This figure is based on the average growth rate between FY05-06 and FY13-14 Salinas City Budgets.)

Revenue from Sales and Property Tax (and Resolution V) was estimated to be 65 percent of General Fund Revenue, initialized at \$50,217,158 (based on publicly available

City reports). This value increases annually over 25 years (to an estimated value of \$88M) as a function of the increase in the ratio of Middle to High Income Earners/Initial number of Middle to High Income Earners (graphing function).

The growth in Revenue has an Impact on Police Capacity. As the Ratio of Revenue / Initial Revenue increases from 1 to 2, the Police Capacity increases from 145 to 320, so that after 25 years, the Police Capacity is at 308 (graphing function based on City projections of police per revenue).

As Revenue per Capita increases, the Quality of Services Factor for Salinas increases over the 25 year run of the model (graphing function, based on AreaVibes estimates).

The Employment Factor for Salinas increases as a function of the increase in Jobs Created (input from another module).

Violent Crimes per Capita, which contributes to the Salinas Community Security Factor, decreases as crimes committed by Gang Members decreases (input from another module).

Water availability decreases as commercial and residential demand increases (input from another module) and is also a function of total water volume. A Specific Yield Rate increase in approximately year 20, makes more water available, but diminishes the total volume of water at an increased rate over time.





Crime rates include violent and property crime. Violent crime includes: murder, rape, robbery and assault. Property crime includes: burglary, theft and vehicle theft. The two are then merged into an index. Higher weights are given to violent crimes. The score is calculated based on comparisons to both state and national averages.

**Education:**

To determine the education score, the following criteria is used: student to teacher ratio, education level achieved and number of schools nearby. The score is then calculated based on comparisons to both state and national averages.

**Employment:**

To determine the employment score, the following criteria is used: income per capita, median household income and unemployment rates. The score is then calculated based on comparisons to both state and national averages.

**Housing:**

To determine the housing score, a combination of factors were used including: median home values in relation to median household income as well as median rent values in relation to median household income for renter occupied dwellings. Also included were appreciation rates for average home prices for the previous 10 years. The score is then calculated based on comparisons to both state and national averages.

**Weather:**

To determine the weather score, the following factors were used: average temperatures for summer and winter months as well as precipitation. Ideal summer average temperatures would be approximately 75° and average winter temperatures of 55° would garner high marks.

**Data Sources:**

The data are obtained from the U.S. Census Bureau, Google Places, FBI Uniform Crime Reports, Council for Community and Economic Research, U.S. Environmental Protection Agency, and the National Weather Service.

Source: <http://www.areavibes.com/methodology/>

**Equations for High Income Earners, Area Attractiveness Module**

Middle\_to\_High\_Income\_Individuals(t) = Middle\_to\_High\_Income\_Individuals(t - dt) + (New\_Mid\_to\_High\_Earners\_Entering - Leaving\_Area) \* dt

INIT Middle\_to\_High\_Income\_Individuals = 24096

INFLOWS:

New\_Mid\_to\_High\_Earners\_Entering = total\_Flow\_In+Expected\_Growth

OUTFLOWS:

Leaving\_Area = Middle\_to\_High\_Income\_Individuals\*.0079

Area\_Attractiveness\_Score=(Community\_Security\_Ratio\*3.50)\*(Quality\_of\_Schools\_Ratio\*1.00)\*(Quality\_of\_Service\_Ratio\*1.00)\*(Employment\_Ratio\*2.00)\*(Cost\_of\_Living\_Ratio\*2.00)\*(Water\_Ratio\*.50)

City\_Population = Projected\_Growth+(((155000+Middle\_to\_High\_Income\_Individuals)-(Middle\_to\_High\_Income\_Individuals\*.005))-24096)

CoL\_Avg = 0.5

Community\_Security\_Ratio = Salinas\_Sec\_Rating/CS\_Avg

Cost\_of\_Living\_Ratio = Salinas\_Cost\_of\_Living\_Rating/CoL\_Avg

CS\_Avg = 3.6

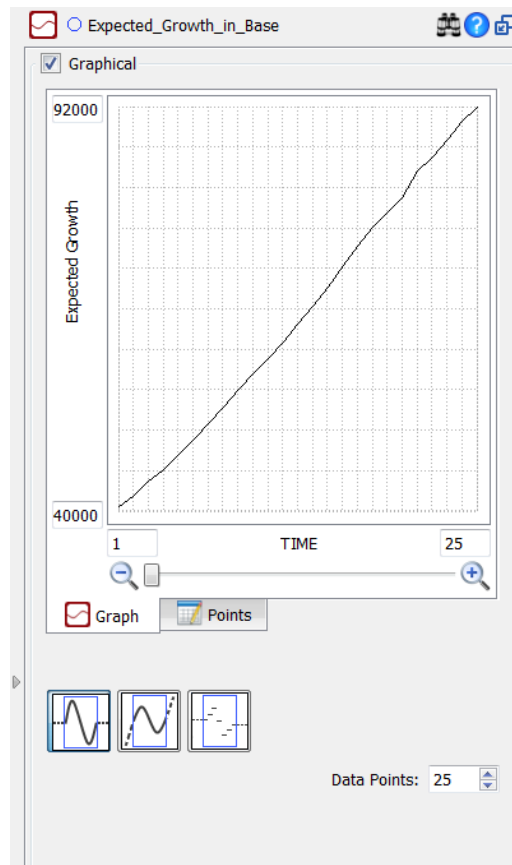
Employment\_Ratio = Salinas\_Em\_Rating/Emp\_Avg

Emp\_Avg = 3.4

Expected\_Growth = Middle\_to\_High\_Income\_Individuals\*.005

Expected\_Growth\_in\_Base = GRAPH(TIME)

(1.00, 2.7e+007), (2.00, 2.8e+007), (3.00, 2.8e+007), (4.00, 2.9e+007), (5.00, 3e+007),  
(6.00, 3e+007), (7.00, 3.1e+007), (8.00, 3.2e+007), (9.00, 3.3e+007), (10.0, 3.3e+007),  
(11.0, 3.4e+007), (12.0, 3.5e+007), (13.0, 3.6e+007), (14.0, 3.6e+007), (15.0, 3.7e+007),  
(16.0, 3.8e+007), (17.0, 3.9e+007), (18.0, 4e+007), (19.0, 4.1e+007), (20.0, 4.1e+007),  
(21.0, 4.2e+007), (22.0, 4.3e+007), (23.0, 4.4e+007), (24.0, 4.5e+007), (25.0, 4.5e+007)



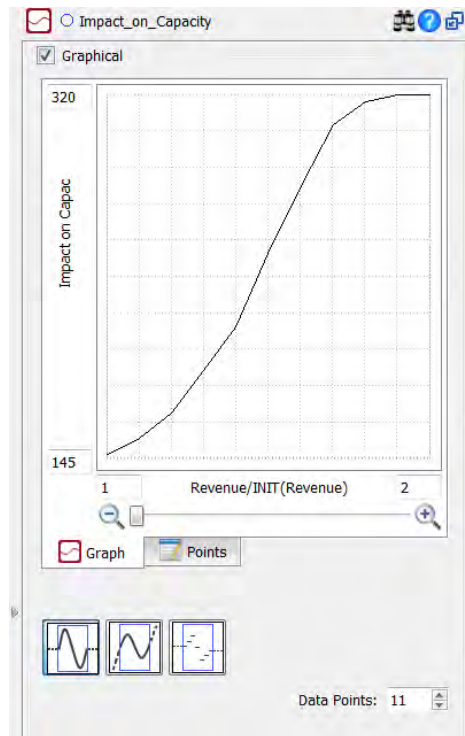
High\_income\_per\_populaton = Middle\_to\_High\_Income\_Individuals/City\_Population

Impact\_of\_Att\_Score=

IF((Normalized\_score)>0)THEN(Normalized\_score\*Potential\_Movers)ELSE(0)

Impact\_on\_Capacity = GRAPH(Revenue/INIT(Revenue))

(1.00, 147), (1.10, 155), (1.20, 167), (1.30, 188), (1.40, 208), (1.50, 244), (1.60, 276),  
(1.70, 306), (1.80, 317), (1.90, 320), (2.00, 320)



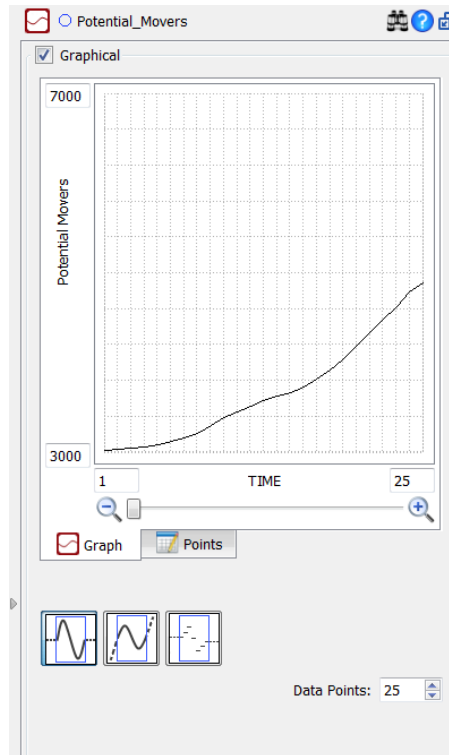
Impact\_on\_Rev = Property\_and\_Sales\_Tax

Normalized\_score = Area\_Attractiveness\_Score/7

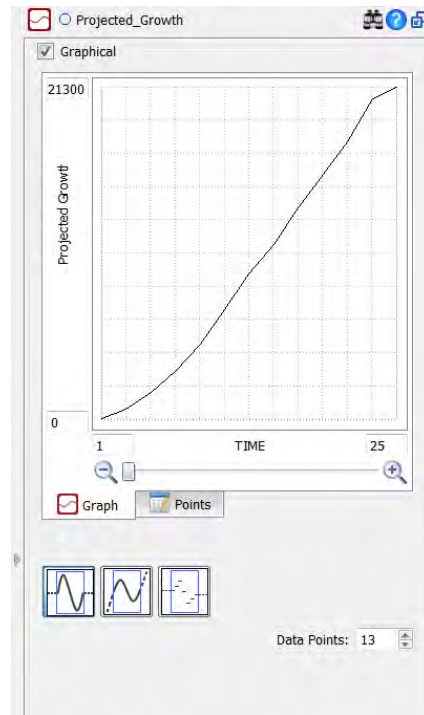
Police\_Capacity = Impact\_on\_Capacity

Potential\_Movers = GRAPH(TIME)

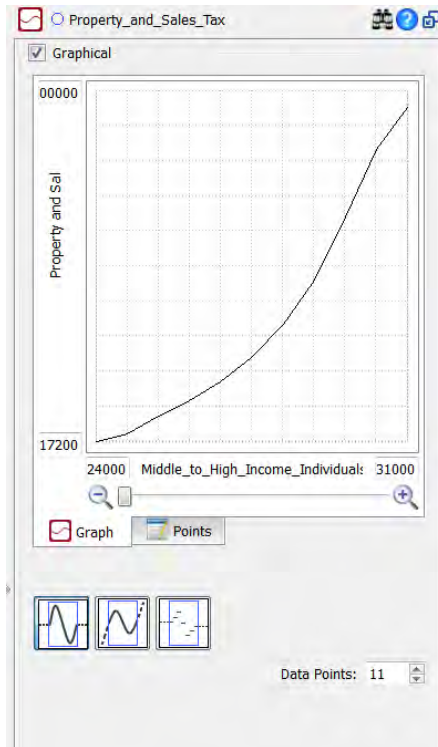
(1.00, 3025), (2.00, 3038), (3.00, 3050), (4.00, 3063), (5.00, 3088), (6.00, 3126), (7.00, 3164), (8.00, 3215), (9.00, 3303), (10.0, 3391), (11.0, 3454), (12.0, 3517), (13.0, 3580), (14.0, 3631), (15.0, 3669), (16.0, 3732), (17.0, 3820), (18.0, 3921), (19.0, 4047), (20.0, 4186), (21.0, 4338), (22.0, 4489), (23.0, 4628), (24.0, 4792), (25.0, 4893)



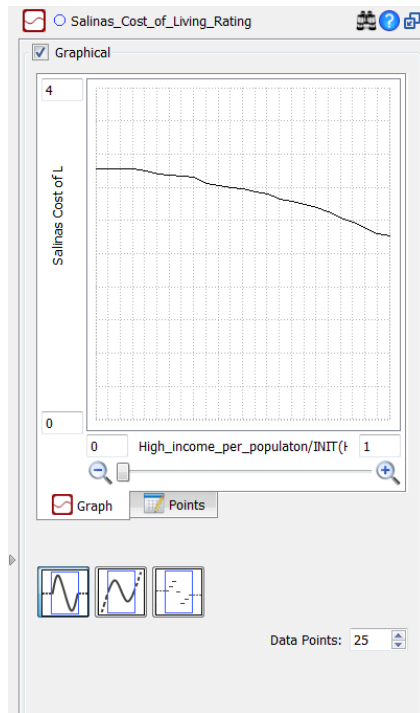
Projected\_Growth = GRAPH(TIME)  
 (1.00, 67.2), (3.00, 672), (5.00, 1747), (7.00, 3091), (9.00, 4838), (11.0, 7055), (13.0, 9340), (15.0, 11221), (17.0, 13573), (19.0, 15723), (21.0, 17806), (23.0, 20561), (25.0, 21300)



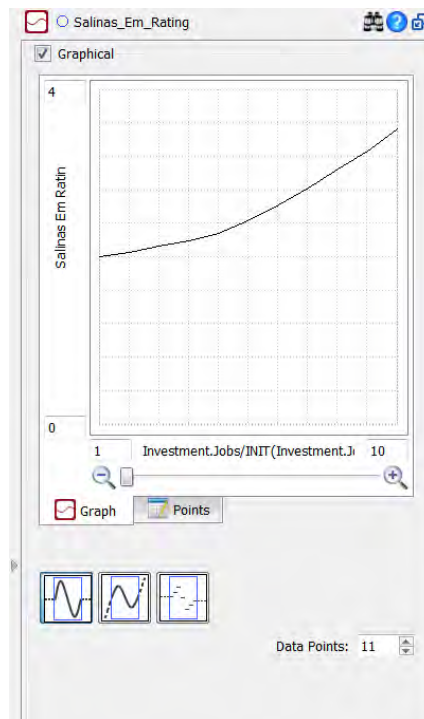
Property\_and\_Sales\_Tax = GRAPH(Middle\_to\_High\_Income\_Individuals)  
 (24000, 5e+007), (24700, 5.1e+007), (25400, 5.3e+007), (26100, 5.5e+007), (26800, 5.7e+007), (27500, 6e+007), (28200, 6.4e+007), (28900, 6.9e+007), (29600, 7.6e+007), (30300, 8.3e+007), (31000, 8.8e+007)



$\text{Quality\_of\_Schools\_Ratio} = \text{Salnas\_QoS} / \text{Schools\_Avg}$   
 $\text{Quality\_of\_Service\_Ratio} = \text{Salinas\_Serv\_Rating} / \text{Service\_Avg}$   
 $\text{Revenue} = \text{Expected\_Growth\_in\_Base} + \text{Impact\_on\_Rev}$   
 $\text{Salinas\_Cost\_of\_Living\_Rating} =$   
 $\text{GRAPH}(\text{High\_income\_per\_populaton} / \text{INIT}(\text{High\_income\_per\_populaton}))$   
 (0.00, 3.03), (0.0417, 3.03), (0.0833, 3.03), (0.125, 3.03), (0.167, 3.00), (0.208, 2.97),  
 (0.25, 2.95), (0.292, 2.94), (0.333, 2.93), (0.375, 2.85), (0.417, 2.83), (0.458, 2.80), (0.5,  
 2.79), (0.542, 2.75), (0.583, 2.73), (0.625, 2.66), (0.667, 2.64), (0.708, 2.60), (0.75, 2.56),  
 (0.792, 2.51), (0.833, 2.44), (0.875, 2.38), (0.917, 2.31), (0.958, 2.25), (1.00, 2.22)



Salinas\_Em\_Rating = GRAPH(Investment.Jobs/INIT(Investment.Jobs))  
 (1.00, 2.01), (1.90, 2.06), (2.80, 2.13), (3.70, 2.20), (4.60, 2.28), (5.50, 2.44), (6.40, 2.62),  
 (7.30, 2.83), (8.20, 3.05), (9.10, 3.27), (10.0, 3.53)

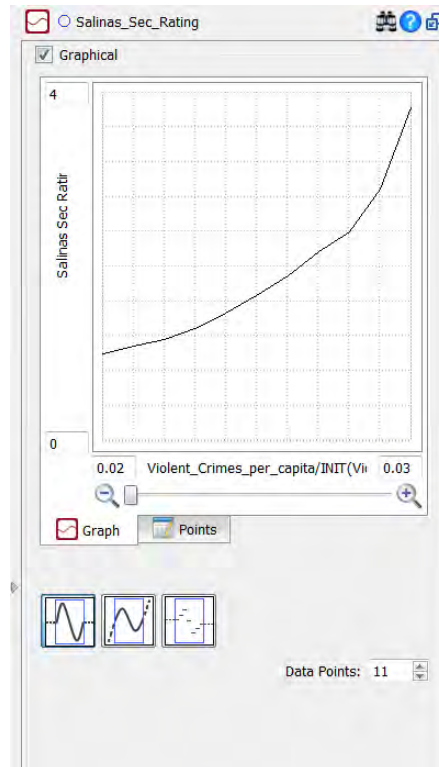


Salinas\_Rev\_per\_capita = Revenue/City\_Population

Salinas\_Sec\_Rating=

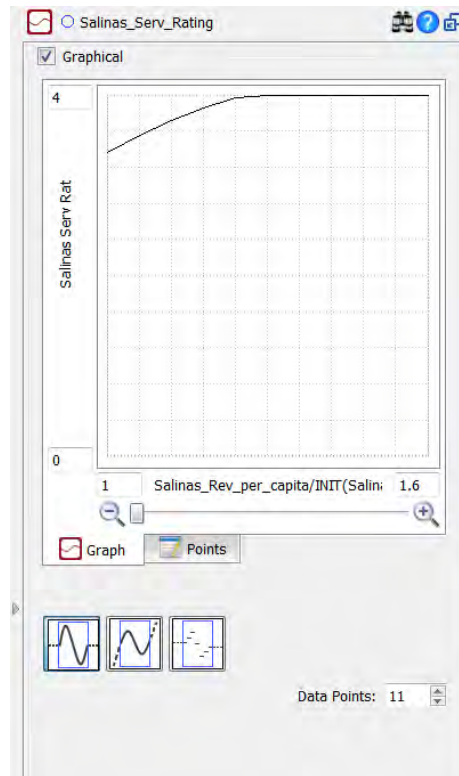
GRAPH(Violent\_Crimes\_per\_capita/INIT(Violent\_Crimes\_per\_capita))

(0.02, 0.997), (0.021, 1.09), (0.022, 1.16), (0.023, 1.29), (0.024, 1.46), (0.025, 1.67),  
(0.026, 1.89), (0.027, 2.17), (0.028, 2.40), (0.029, 2.89), (0.03, 3.82)

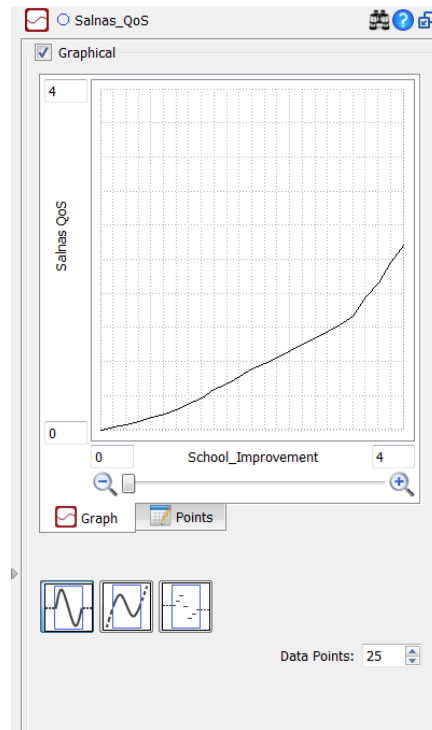


Salinas\_Serv\_Rating = GRAPH(Salinas\_Rev\_per\_capita/INIT(Salinas\_Rev\_per\_capita))  
(1.00, 3.37), (1.06, 3.56), (1.12, 3.72), (1.18, 3.86), (1.24, 3.97), (1.30, 4.00), (1.36, 4.00),  
(1.42, 4.00), (1.48, 4.00), (1.54, 4.00), (1.60, 4.00)





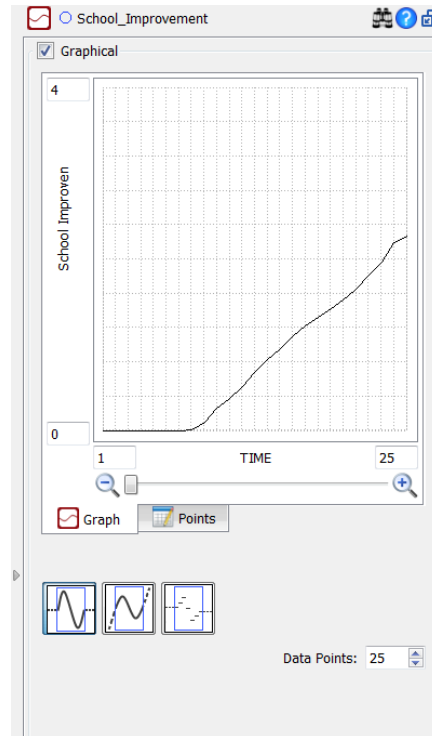
Salinas\_QoS = GRAPH(School\_Improvement)  
 (0.00, 0.00), (0.167, 0.0379), (0.333, 0.0631), (0.5, 0.101), (0.667, 0.151), (0.833, 0.189),  
 (1.00, 0.24), (1.17, 0.315), (1.33, 0.379), (1.50, 0.479), (1.67, 0.543), (1.83, 0.631), (2.00,  
 0.719), (2.17, 0.782), (2.33, 0.858), (2.50, 0.934), (2.67, 1.01), (2.83, 1.09), (3.00, 1.16),  
 (3.17, 1.24), (3.33, 1.34), (3.50, 1.56), (3.67, 1.73), (3.83, 1.97), (4.00, 2.17)



Schools\_Avg = 2.2

School\_Improvement = GRAPH(TIME)

(1.00, 0.00), (2.00, 0.00), (3.00, 0.00), (4.00, 0.00), (5.00, 0.00), (6.00, 0.00), (7.00, 0.00),  
 (8.00, 0.0126), (9.00, 0.101), (10.0, 0.265), (11.0, 0.379), (12.0, 0.517), (13.0, 0.681),  
 (14.0, 0.833), (15.0, 0.959), (16.0, 1.11), (17.0, 1.22), (18.0, 1.32), (19.0, 1.43), (20.0,  
 1.53), (21.0, 1.65), (22.0, 1.82), (23.0, 1.97), (24.0, 2.20), (25.0, 2.27)



Service\_Avg = 4

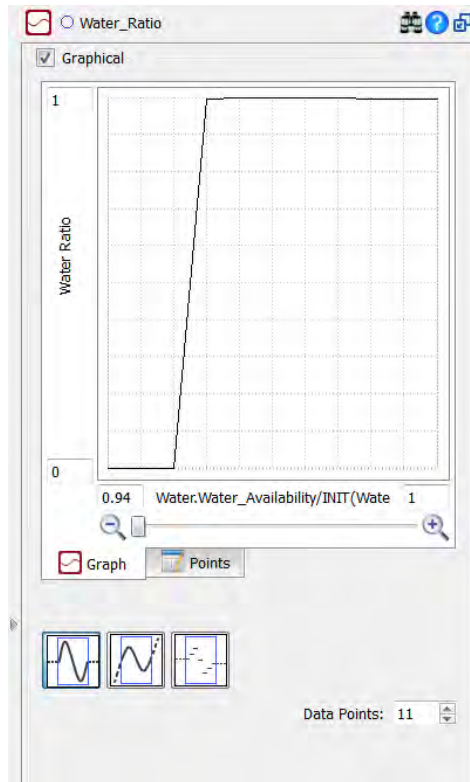
total\_Flow\_In = Impact\_of\_Att\_Score

Total\_to\_High\_Income\_Individuals = Middle\_to\_High\_Income\_Individuals

Violent\_Crimes\_per\_capita = Gangs.Violent\_Crimes\_Total/City\_Population

Water\_Ratio = GRAPH(Water.Water\_Availability/INIT(Water.Water\_Availability))

(0.94, 0.00), (0.946, 0.00), (0.952, 0.00), (0.958, 0.997), (0.964, 1.00), (0.97, 1.00),  
(0.976, 1.00), (0.982, 1.00), (0.988, 0.997), (0.994, 0.997), (1.00, 0.997)



## **APPENDIX C. TABLES OF PARTICIPANT COMMENTS**

The following tables correspond to the sub-sections of Chapter V as noted:

### **Advantage One: A Common Understanding of the Strategic Environment**

Agreement on What Caused the Decline of Salinas (Table 1)

Agreement on The Way Ahead (Table 2)

### **Advantage Two: Development of a Broad Scope of Objectives**

Agreement on the Development of a Broad Scope of Objectives: The Cluster Linking Silicon Valley to Salinas to Address Global Challenges (Table 3)

Agreement on the Development of a Broad Scope of Objectives: A Culture of Entrepreneurialism (Table 4)

Agreement on the Development of a Broad Scope of Objectives: Providing Opportunity Through Education (Table 5)

Agreement on the Development of a Broad Scope of Objectives: The Need to Collaborate with Universities for Research (Table 6)

Agreement on the Development of a Broad Scope of Objectives: Overcoming Local Resistance in the Agriculture Sector to Collaborative vs Competitive Business Practices (Table 7)

Agreement on the Development of a Broad Scope of Objectives: Cultivating and Exploiting Professional, Academic, and Community Networks (Table 8)

### **Limitation One: Disagreement on Social Benefit vs Profit Motive (Table 9)**

### **Limitation Two: Lack of an Identified Leader and Prioritization (Table 10)**

### **Mental Models of Systems Thinking (Table 11)**

### **Mental Models of Time Horizon for Implementation (Table 12)**

### **Mental Models of Theories of Economic Development (Table 13)**

### **The Image of Gang Violence—Emic and Etic Perspectives (Table 14)**

### **The Self-Image of Salinas (Table 15)**

### **Marketing a New Image (Table 16)**

### **Areas of Impact: Insights Gained (Table 17)**

### **Areas of Impact: Understanding Sub-systems within the Strategy (Table 18)**

### **Areas of Impact: Potential Model Applications (Table 19)**

	<b>Agreement on What Caused the Decline of Salinas?</b>
<i>Private Sector Group</i>	
Hartnett	“Salinas’ reputation is hampered by some negative press... specifically around some of the gangs.” “...we’ve gone through a very tough economic downturn... it was a combination of that macroeconomic shift, combined with...the bigger kind of macro perception of the region.”
Meador	“It’s not just one thing, we were faced with the whole downturn of the economy in the country.”
Fitzgerald	“They are an agriculture community embedded in the 20 <sup>th</sup> and even the 19 <sup>th</sup> century way of conducting business and conducting government.” “They have no understanding of how to move forward and deal with that in a 21 <sup>st</sup> century model utilizing technology, utilizing business possibilities.”
<i>Non-Profit Group</i>	
D’Arrigo	“We lost most of our big manufacturing companies...and I think our ability to attract new companies has been challenging because we have gang issues that are publicized widely by the media and there’s also the notion that our school systems could be better, at least our public school systems.”
Thompson	“I think Salinas, like the entire country, was hit very hard by the recession.” “Ag companies have not been interested in investing in or building a Salinas workforce ... so there has been a lack of initiative, a lack of progressiveness, a lack of serious investment in education, in new economic infrastructure.”
Fogg	“Salinas now suffers from the cycle that results from economic and social decline and the struggles to get out of that process... needing a better educational system, a better educated workforce, a better supported workforce, and freedom from gang activity and crime which perpetuates the problem.”
<i>Civic Group</i>	
Donohue	“Salinas’s economy came to a grinding halt thanks to the national economic downturn.” “...we just simply haven’t had the resources to keep up some of our basic infrastructure needs and, more importantly, provide the amenities like parks and sufficient libraries that make a city attractive to perspective employers.”
Corpuz	“The decline came as a result of some national influence... less revenues for the city from the government, particularly the state, less economic activity by the largest industry, which is agriculture, and all related industries that sort of feed off of that in the Salinas area and valley.”
Weir	“We do not have support from the dominate industry, Ag, to continue to put money into the community, we have a \$600-plus million dollar shortfall in investment for roads and sewers and streets and parks, and we are never going to catch up unless we raise more revenue.”

Table 1. What Caused the Decline of Salinas?

	<b>Agreement on the Way Ahead</b>
<i>Private Sector Group</i>	
Hartnett	“A strategy has to be built on solid foundations, ruddered in aspirations, and those solid foundations for me were a \$10 billion ag business, one hour south of Silicon Valley.” “Innovation, to me, was the tip of the spear. “ “We’re building it off of a strength, the strength of agriculture, the linkage into Silicon Valley, the linkage into corporates...it becomes a commercial thing that will evolve.”
Meador	“The city had a need, the city has a responsibility to grow the community, to provide economic development.”
Fitzgerald	“Connect Silicon Valley technology with the Salinas community in order to look at the possibility of increasing jobs and connecting Silicon Valley with Salinas...to support the possibility of growing entrepreneurial businesses.”
<i>Non-Profit Group</i>	
D’Arrigo	“We have a huge opportunity here and a responsibility to produce more food, more effectively with less water, with less inputs... Ag-tech is the future for the industry.”
Thompson	“Marry it (Silicon Valley) to the traditional agricultural economy of the Salinas Valley and the Salinas area...(to) create better jobs for the local community.”
Fogg	“Everyone came in around this vision, this will become the project or the series of projects that bring together all of the incredible strengths that this region has to elevate a community in Salinas...to improve their daily lives and their prospects for the future; their opportunity to hope and to choose the path that they want not the path they are forced down.”
<i>Civic Group</i>	
Donohue	“There was always a plan and always a desire to reach and, on a top line basis, connect the Salinas Valley with the Silicon Valley.”
Corpuz	“A turning point, we came to a conclusion that agricultural technology and innovation would be a strength that we needed to push.”
Weir	“The whole focus on innovation, its role and its need was identified early on... our opportunity for innovation and technology was near at hand, 60 miles to the north, called Silicon Valley.”

Table 2. The Way Ahead

	<b>Agreement on the Development of a Broad Scope of Objectives: The Cluster Linking Silicon Valley to Salinas to Address Global Challenges</b>
<i>Private Sector Group</i>	
Hartnett	“These clusters, they evolve over time and they may have a specific deep capability and strength in specific areas.”
Meador	“If we don’t have economic development here, it will be a tragedy in our community... We will become just farm land and agriculture here.”
Fitzgerald	“I began understanding what the cluster was, what the potential was economically, sociologically, financially.”
<i>Non-Profit Group</i>	
D’Arrigo	“The cluster for me was very broad in its scope and it had to have all these pieces to really be successful... I think a lot of the resource we have now we’re sort of tapped out—there hasn’t been a lot of change in (the agriculture) industry since drip irrigation which was fifteen years ago.”
Thompson	“All the different legs that the cluster established...have to all be working together in beautiful sync and harmony...the bottom line is trying to make Salinas a better place.”
Fogg	“...all of this then fed into what at the time we viewed as the sort of reason for being of this cluster, which was water, food, energy and waste challenges and finding solutions to these major global challenges through ag-tech and this industrial cluster here.”
<i>Civic Group</i>	
Donohue	“What I think all of the early stakeholders agreed upon was...the vision is to create an ag tech cluster...we need to create a culture of innovation that permeates the community and the region .... creating the future of the industry... the need to address food and water issues over the next several decades.”
Corpuz	“At that time we were thinking about sort of a cluster approach...that could be (a) platform on which we could base a number of initiatives... The connections of how water, energy, and waste could work in terms of this effort for smart farming.”
Weir	“The major industry here, agriculture, had to begin to position itself to adopt and accept technology... with the emphasis on waste, energy and water...for food production... the whole need, growing need throughout the world.”

Table 3. The Cluster Linking Silicon Valley to Salinas



	<b>Agreement on the Development of a Broad Scope of Objectives: A Culture of Entrepreneurialism</b>
<i>Private Sector Group</i>	
Hartnett	“An entrepreneurial activity has to have a focus... if you look at the success of, whether it’s clusters or entrepreneurial endeavors by regions or cities, it’s an entrepreneur is going to lead this.”
Meador	“You’re bringing along your next generation of entrepreneurs that will develop business down the road, in a different way than what we’ve seen (in) business.”
Fitzgerald	“Part of the Steinbeck proposal was Kaufman, how to educate people to be entrepreneurs and start businesses.”
<i>Non-Profit Group</i>	
D’Arrigo	“I think we have the opportunity to attract businesses from outside the area to come here, businesses that can synch up with agriculture and be very successful... seeding new entrepreneurs and new businesses, that’s a real key component.”
Thompson	“My understanding of the strategy was to build a good solid foundation that incorporated all the legs of the proposal, the technology leg of it, the finance part, the entrepreneurial leg of it, the investment part.”
Fogg	“A physical innovation center that...will incubate entrepreneurs and start-up companies in Salinas...was always part of the vision.” “You can imagine this place being the source of all these innovations and creating prosperity.”
<i>Civic Group</i>	
Donohue	“At the end of the day, there needed to be people, goods and services in the marketplace, creating new opportunities, willing to take a risk, and there had to be an investment vehicle.”
Corpuz	“If you’re gonna do innovation, if you’re gonna do technology, then you gotta create the businesses, and you gotta create the culture and the support system so entrepreneurialism can take place.” “The entrepreneurial part is key, and you gotta support it with every incentive that you can create, either as a city or bring in from other resources.”
Weir	“Entrepreneurs can recognize there’s a wonderful opportunity here to do something new and different, that has meaning and value, whether it’s economic or other social or whatever.”

Table 4. A Culture of Entrepreneurialism

	<b>Agreement on the Development of a Broad Scope of Objectives: Providing Opportunity Through Education</b>
<i>Private Sector Group</i>	
Hartnett	“It’s opening up the pipeline of innovation both in the short term and the long term.” “On the short term, the research work that’s been done...and then at the same time, doing more longer-term building of the entrepreneur program and CoderDojo.”
Meador	“You’ve got to plan for your children is a key element.”
Fitzgerald	“As part of the overall Steinbeck plan, education was going to be a cornerstone, education not initially at the grassroots level at the grammar school, high school, so on, but entering the community at a level to teach folks how to set and structure business.”
<i>Non-Profit Group</i>	
D’Arrigo	“The vision was economic development, the education piece—getting ag-tech jobs available for kids so when they graduate, first of all that they are going on to further their education here, and then to really keep them in our community.”
Thompson	“I think for the children of the community, the idea that there are other options to them.” “If you don’t have a good educational system, you’re not gonna have good leaders, you’re not gonna have good citizens.”
Fogg	“If you don’t have a solid education system you don’t have a labor force that can then support the companies that are coming in and can start new companies and come up with new ideas, you don’t have that pipeline to continue this into the future.”
<i>Civic Group</i>	
Donohue	“The reality is, if tomorrow looks the same as today you keep repeating that. In Salinas’s case, we need sea change,” “We’re gonna be playing back fill, before we turn out a whole generation of STEM kids.” “When you bring tech into the game, that’s a young person’s game.”
Corpuz	“You gotta create the culture and the support system so entrepreneurialism can take place, the education support...”
Weir	“We had a lot of young people here that were able to be as competitive on an intern opportunity basis as graduates from MIT or students at MIT, after they became educated, most of them turned away from Salinas because they sought a job, and we didn’t offer those jobs.” “The value of what we’re doing is really focused on giving you an opportunity.”

Table 5. Providing Opportunity Through Education

	<b>Agreement on the Development of a Broad Scope of Objectives: The Need to Collaborate with Universities for Research</b>
<i>Private Sector Group</i>	
Hartnett	"...ideas come from universities. Research will come from universities."
Meador	"I see that the next check box is to get back involved with the universities... tapping into the research minds as a key component, along with the investment."
Fitzgerald	"We got a lot of MOUs in place...and that's the piece I think we should have focused on... using the MOUs with the various academic institutions and then having the connections within Silicon Valley."
<i>Non-Profit Group</i>	
D'Arrigo	"We spent a lot of time developing framework for the MOUs with the universities and local colleges...we felt like developing MOUs with universities would be key to our success to move forward in the ag-tech space."
Thompson	"We're talking about using high technology and sensors that farmers can put in fields and use their iPhone to check out the salinity in the water and all that." "Individual meetings between such parties as the scientists from Georgia Tech and Stanford University and UC Davis." "Form all these really powerful relationships with organizations and institutions, educational institutions, academic institutions. Academic thought leaders."
Fogg	"There was also a lot of emphasis on bringing in academic observers and participants, forming MOUs with universities. "Institutions and individuals that are committed to the advanced research component are absolutely key and need to be engaged early on this because they're the ones who can take those high risk ideas and try to pursue them."
<i>Civic Group</i>	
Donohue	"Bringing academia together around this proposition was important." "We need to draw in research that's focused around the real needs of the industry."
Corpuz	"The effort to develop the research pipeline is key." "We wanted them (universities) to be the pipeline for the ideas, the creativity, to translate, to be able to take those ideas and innovations, translate them and commercialize them into products that would help agriculture, our industry here."
Weir	"The whole idea of getting MOUs together with universities and doing other outreach... it's gonna be through the innovation technology that comes out of research."

Table 6. The Need to Collaborate with Universities for Research

	<b>Agreement on the Development of a Broad Scope of Objectives: Overcoming Local Resistance in the Agriculture Sector to Collaborative vs Competitive Business Practices</b>
<i>Private Sector Group</i>	
Hartnett	“They’re all strong companies, but none of them are talking to each other, they’re all siloed... they’re all kind of like protective companies.”
Meador	“There’s still a lot of competition within business, of people wanting to get an edge on the other company, especially in the ag industry.” “To me, it’s very shortsighted... that competitiveness can actually hurt you. And cost you a lot of money.”
Fitzgerald	“They have no understanding of how to... deal with that in a 21 <sup>st</sup> century model utilizing technology, utilizing business possibilities rather than the old line governmental and agricultural infrastructure... they’re not working as smart as they could.”
<i>Non-Profit Group</i>	
D’Arrigo	“The group that I kind of see moving the slowest is the agricultural community, even though I think they have tremendous benefit, they may not see it as clearly.” “They’ve got to make the investment in it... that’s going to cost money.”
Thompson	“It is just the nature of the business, what it costs to produce food, to produce agriculture the way they do, what it costs the farmer to stay in business...it has affected all of their economic decisions.”
Fogg	“This, by nature, is intended to introduce lots of new ideas and bring new stakeholders into the profit mix, the economic mix...but I can absolutely see the private sector side feeling threatened or concerned about intellectual property issues or protecting competitive advantage, that kind of thing.”
<i>Civic Group</i>	
Donohue	“We control or touch probably 70, 80, 90 percent of fresh value-added processing capacity every day... But there’s a decision-making process concentrated in very few hands.”
Corpuz	“For generations, these families had their own growers, farmers, producers, and they dominated the industry here, but as I looked into it deeper, there is not this collaboration between the industries.” “It was more competitive and, in some cases, more than competitive, it was, who sort of controlled the input and outputs here, in a macro fashion, in economic fashion.”
Weir	“(Agriculture leaders) were internalized within their own companies, not necessarily looking for partnerships.”

Table 7. Overcoming Local Resistance in the Agriculture Sector

	<b>Agreement on the Development of a Broad Scope of Objectives: Cultivating and Exploiting Professional, Academic, and Community Networks</b>
<i>Private Sector Group</i>	
Hartnett	“Outside the area, I’d spoken to ... one of the icons of Silicon Valley.” “I also spoke to...probably the number one venture capital firm in Silicon Valley.” “I specifically brought in a good friend of mine... a venture capitalist.” “Somebody has to be the evangelist and, to me that was Bruce (Taylor).”
Meador	“...the Apples, the Googles, the very successful businesses out there that can drive revenue and put the revenue back into the economy.” “But I also mean the agricultural industry.”
Fitzgerald	“If the folks from the Cluster have to drive it through each organization it’s not going to work... they’ve gotta collaborate within the organization... they’ve got to get the City buying in...and then they’re got to go, to the private business community.”
<i>Non-Profit Group</i>	
D’Arrigo	“I think the City is realizing that we’re all completely interdependent on each other, so the City, the County, the County Health Department, Monterey County Office of Education, the business community we’re all in this together.” “Certainly on the business side Bruce Taylor has stepped up and has been a huge supporter.”
Thompson	“The strategy was to...form all these really powerful relationships with organizations and institutions, educational institutions, academic institutions... connect up all these thought leaders.”
Fogg	“It was to be this ecosystem of interconnected relationships between the business community, the non-profit community and the community at large, including education and advanced research.”
<i>Civic Group</i>	
Donohue	“I was already interested in working with... John (Hartnett) and his group and his network... so, we had...an effective linkup to the Silicon Valley.” “Bruce Taylor’s early support was critical... to make the case to the industry that this was going to be a unique opportunity.” “You simply cannot marry ag and tech if one doesn’t come without the other.”
Corpuz	“Personal and professional networks...unless we had that, we couldn’t get anywhere with the entrepreneurial effort, we couldn’t get anywhere with the VC effort, we couldn’t get anywhere with angel or corporate support.” “Once (Bruce) Taylor came on, it was a little easier convincing the rest... as a way to attract businesses, to open doors, to open new networks for opportunity.”
Weir	“Hartnett, Donohue, and others, they brought people to us.” “Educators... because they have their own network.” “But we also had other community leaders and the ag leaders themselves, Bruce Taylor in particular.”

Table 8. Cultivating and Exploiting Professional, Academic, and Community Networks

	<b>Limitation: Disagreement on Social Benefit Versus Profit Motive</b>
<i>Private Sector Group</i>	
Hartnett	“Companies create jobs, it’s not governments and it’s not universities.” “Ideas come from universities, research will come from universities, but they’re not employing thousands of people.” “It’s an entrepreneur is going to lead this, not gonna be an academic, it’s not gonna be a city manager.”
Meador	“Most nonprofits that I’ve been involved in...only have a piece of the sector and do not have the entire model of how to really hit the home run down at the end.” “If we don’t have the investment fund and the dollars, this project will not move forward... because you’re not going to get money from the city or the counties.”
Fitzgerald	“You want to save the world for democracy, but tell me who, what, when, where, how, and why, answer those five questions.” “Because this has to be a commercially viable effort, how much is it going to cost and what is the profitability and revenue model?” “Well-meaning doesn’t equate to success.”
<i>Non-Profit Group</i>	
D’Arrigo	“That was the most important piece, to get the Foundation up and going so that we had a non-profit piece, a 501c3... so that we can continue to fund the research, get the projects here, get them deployed, get results.
Thompson	“The investment has to be there, but it also has to be done in such (a way) that it’s not strictly driven by the profit motive and the profit motive alone.”
Fogg	“There’s a siren song that one hears from the private sector that there’s a lot of money right away and that it can move very quickly and it’s sexy to be supported by the business leadership that are high profile in our communities.” “We all see it as a priority in society to continue to push the limits and figure out if we can go to the moon; (the) private sector won’t do that until they’ve seen it demonstrated that it can happen or create some profit.”
<i>Civic Group</i>	
Donohue	“Ultimately, from the community standpoint... there’s the investment piece and then there’s (the) Foundation piece, and the Foundation is nonprofit, purposeful, community benefit.”
Corpuz	“If we’re talking about new businesses and jobs, guess what, government doesn’t do that, private-sector creates the jobs... but, we could partner.” “We have a real opportunity to showcase a new public private partnership in agriculture technology.”
Weir	“It needs to be sustainable on its own merits and through its own efforts, and not just by raising money and those kinds of things.” “It needs to be of human value, more than anything else... I don’t want to get into all the social belief things I have.”

Table 9. Disagreement on Social Benefit Versus Profit Motive

	<b>Limitation: Lack of an Identified Leader and Prioritization</b>
<i>Private Sector Group</i>	
Hartnett	“It was good to have the broader group involved, feeding in information, but when we shifted to the smaller group (the Executive Committee)...that was then suddenly moving it from discussion and talk to action orientated.” “We were able to have more dialogue on some of the challenges and the issues and start to drive this forward... we seemed to have...full control of what we were doing.”
Meador	“When Mayor Dennis Donohue wasn’t mayor anymore... I could see that the changing of the guards wasn’t gonna work, the model might fail, because the new regime really hadn’t been on board with what we were doing.” “I saw that and went to work immediately with Ray Corpuz to...build the relationship between John Hartnett, Captain Wayne Porter... and (incoming) Mayor Joe Gunter.”
Fitzgerald	“There has to be a cohesive focus on who is the leader, how much time are they going to spend on this, who’s going to be in charge of pushing whatever it is? “And that’s not was happening.” “The key leaders were John Hartnett and Dennis Donohue.” “It’s a business model, there’s a CEO, or chairman, but for this to move forward then somebody has to be a leader.”
<i>Non-Profit Group</i>	
D’Arrigo	“It was definitely hard to kind of stay on track and stay focused... I think now our biggest challenge is staying aligned, making sure that we’re all focused on the priorities.” “Those priorities have shifted through the process depending on where we were.”
Thompson	“You are going to have to compromise on things...which means basically people putting their heads together in a setting with a common goal in mind, but knowing that we are working together.” “No one person is more important than the other.”
Fogg	“I’ve learned how challenging it can be to not have a single leader in an organization, and I believe that’s the only weakness that can jeopardize the forward momentum of this.”
<i>Civic Group</i>	
Donohue	“Even when people want the same thing, it’s still not easy... even when people who are well intentioned and want the same thing, big challenges are hard.” “Alignment is difficult ... So, even when people agree, they don’t agree on how they agree.”
Corpuz	“The key players, obviously, to me were Dennis Donohue, who helped sort of create that opportunity by getting the right people, having a general sense of what the macro picture looked like.” “The top three people were you (Wayne Porter), Dennis, and John.”
Weir	“There were some personalities involved, as there always are... and they were satisfied with having the smaller group effort.” “It isn’t just a single person or entity, it’s so much broader than that.”

Table 10. Lack of an Identified Leader and Prioritization

	<b>Mental Models of Systems Thinking</b>
<i>Private Sector Group</i>	
Hartnett	<p>“I felt that we’re building an ecosystem...when I say this, I’m thinking about Silicon Valley as an ecosystem.” “People describe it like a rain forest...something drops on the ground, it’s gonna get gobbled up and changed and created into something else...an alive ecosystem made of all those kind of key components that are there.”</p> <p>“I started the ecosystem just thinking about the entrepreneurial life cycle, how an entrepreneur starts with an idea, to when it becomes a major corporation employing thousands of people and doing billions of dollars in revenue.” “There’s a whole cycle that happens between getting initial funding, getting your technology deployed, getting critical mass around that, getting scale venture... that was the kind of ecosystem that I was envisioning.”</p>
<i>Non-Profit Group</i>	
Fogg	<p>“What I would conceptualize as a cluster is...an ecosystem of resources, individual expertise, availability of educational and economic supports that together grow a region of expertise.” “As I imagine it, once that is seeded somehow (it) begins to grow on its own.” “Once we have technology in our fields that doesn’t exist anywhere else, we don’t have to ask people to come here anymore, they’re coming because they want to build on that, they want to learn from that, they want to invest more in it.”</p>
<i>Civic Group</i>	
Donohue	<p>“Captain Wayne Porter and I had been talking... your vision and what you were talking about, in economic quarters, was just dead on to what we were talking about and what we needed to do in Salinas.”</p> <p>“And so that dialogue, your systems approach...it was almost like the perfect mix of things kind of running together.” “There are quarters that, if you link them intentionally, can spawn, can bring back manufacturing.” “You cannot, at the end of the day, solve the gang issue, the public safety issue, without economic opportunity, they go hand in hand.” “It’s the perfect place to prove kind of systems thinking.”</p>

Table 11. Mental Models of Systems Thinking



	<b>Mental Models of Time Horizon for Implementation</b>
<i>Private Sector Group</i>	
Hartnett	“As we started to kind of look at the horizon, I was thinking, okay this is maybe a year or two years.” “Aas this has evolved further, I mean, we’re talking about potentially decades here, certainly five-year type of horizon...for success we will see some of the biggest benefits over a decade, not over a year.”
Meador	“This isn’t something that you can implement and, in six months, see the benefit of it, this is...more a lifelong project.” “I think the true creating of jobs and support of the companies and what will come out of that will be really in the second year.”
Fitzgerald	“A few years ago, a guy I was consulting said, ‘What are the metrics you use to measure performance?’ I said, ‘Seconds, minutes, hours, and days.’” “I was being somewhat facetious, but that is essentially what you are measuring now, you’re not measuring a 40 year plan.”
<i>Non-Profit Group</i>	
D’Arrigo	“I’ve been involved in clusters probably for the past twenty five years here in the area, none of them have really taken hold.” “I think it’s moved a lot more quickly than some (clusters) I have been involved in.” “I think because this one has had such incredible momentum people have stayed engaged.”
Thompson	“I realized pretty early on we probably wouldn’t see the real serious effects or quantifiable effects until about a decade or so into it, you know, probably about ten years from now.”
Fogg	“I don’t think it ever matures and reaches fruition.” “So to my mind, we should see impact immediately... what’s beautiful about this is it’s very much a social good experiment but it’s also very fast moving and you see impacts right away, but that won’t end.”
<i>Civic Group</i>	
Donohue	“I understand it has to be over time, that this really does substantively move into the life of the community and takes root.” “The goal, the hope would be within a 3 to 5 year period, perhaps dozens of young companies and hundreds if not thousands of jobs, and, oh, by the way, it might not work.”
Corpuz	“We had to make some very important connections and wins early on, in order to even make this project, this concept, move forward.” “You can go from one of the most violent places to one of the best places to find a job... I’ve seen it in other communities.”
Weir	“It is going to take quite a while...we need to understand these things are not going to happen quickly.” “The real measurement for me is a longer horizon, it’s gonna be 10 to 20 years.”

Table 12. Mental Models of Time Horizon for Implementation

	<b>Mental Models of Theories of Economic Development</b>
<i>Private Sector Group</i>	
Hartnett	“What we’ve done with the Steinbeck Cluster, is to focus on the region’s strength in terms of physical assets to commercial assets, like the critical mass of agriculture companies there and obviously, you know, climate in the region, etc., and so building off the strength that exists.”
Meador	“Pulling the private and business sector together I think, and the county governments together... so you’re bringing not only government, you’re bringing education, and you’re bringing private business all together... to build economic development... you’re building a better foundation for the entire community.”
Fitzgerald	“You come up with your vision, your goals, your mission, your plan, your product, your service, your capability, and you focus then on getting support financially so you can carry it out.” “It starts at the top (with) leadership... so we need the leadership with a plan, but you’ve got to get buy-in from the grassroots to move forward.”
<i>Non-Profit Group</i>	
D’Arrigo	“I think that embracing technology, bringing in more technology into the area, and investing in technology is definitely going to help, not only the Ag industry, but I think the entire county will benefit from that.”
Thompson	“I would try and create more and better means of supporting the young families that are there and the young parents that are there.” “I would find ways to be able to reach out and help them and provide more opportunities, more educational opportunities.”
Fogg	“Personally, I think education intervention is one of the most important pieces... meaning involving the parents, the communities, and the students access to educational support.” “I think this is one of the challenges we face as a nation in trying to promote economic development, we focus on specific parts of that process and we fail to then provide the overall sort of network of growth that will then help create long-term sustainable change.”
<i>Civic Group</i>	
Donohue	“Cities, every facet of government, and really American life, presumes growth and sufficient resources, and where you have sufficient resources, you can enhance quality of life... a rising tide that lifts boats for individuals and communities.”
Corpuz	“It’s economic prosperity and diversity, it’s mobility and excellent infrastructure, it’s the quality of life and the improvement of that... it’s good governing.”
Weir	“It is somewhat economics related and, if we’re not concentrating on what creates a strong local economy, regional economy, state and national economy, and even an international economy, we’re just not paying attention.”

Table 13. Mental Models of Theories of Economic Development

	<b>The Image of Gang Violence—Emic and Etic Perspectives</b>
<i>Private Sector Group</i>	
Hartnett	“The only things I knew about Salinas, to be really honest with you was gangs... I didn’t know whether I’d come out after a meeting and my car is still there.” “Again, it was more perception on my side, because the media in this region is pretty negative.” “Unfortunately, perception probably has hurt investment and continued investment.”
Meador	“I think there’s also the press that we’ve gotten in our area, it’s not like it’s an attractive area to live (in).” “That’s part of the problem, I think that it’s hard to attract major businesses in our area...due to gang violence.”
<i>Non-Profit Group</i>	
D’Arrigo	“I think the challenges that we felt ahead of us for us to move forward, number one was definitely a perception of gang violence in our community.” “That’s a big deterrent to people moving here, putting their kids in school here, and businesses coming into the area.”
Thompson	“I don’t mean gangs in the way that most people think of gangs and Salinas... from what I can tell, the perception has been the stronger agent against Salinas than the actual criminal activity.”
Fogg	“What Salinas has struggled with has to do with a lot of different factors coming together, not the least of which is social and economic problems that go along with having a population that is undereducated, underemployed, and therefore suffers from a lot of social challenges that go along with that.”
<i>Civic Group</i>	
Donohue	“There is a perception that it’s not as safe as it could be in Salinas, and then just once people get that in their mind.” “I always kind of felt we were like the state of Israel, in the sense that we’ll either be surrounded by our past or surrounded by too many people that have a history of this.”
Corpuz	“In Salinas, we’ve had a huge gang problem, severe violence problem with youth... and one of the reasons I think that that exists, because there isn’t another hope or opportunity here.”
Weir	“If a young person doesn’t have any hope for a future to be like everybody else and everything else he sees around him or her, why would they not make (a) bad choice?”

Table 14. The Image of Gang Violence—Emic and Etic Perspectives

	<b>The Self-Image of Salinas</b>
<i>Private Sector Group</i>	
Meador	“There’s labor issues, there’s water issues, there’s governmental issues...all of those different issues affect people in wanting to do business and then moving to other areas.”
<i>Non-Profit Group</i>	
D’Arrigo	“John Hartnett provided great leadership from Silicon Valley...how to look at economic development a little bit differently than I think we would have done it here in the City.” “With our small-minded thinking, he gives us little bit bigger perspective.”
Thompson	“There is also a perception...amongst Salinas residents and the community that Salinas is just a little podunk Salinas and it isn’t important, not much to do, not much to see here.”
Fogg	“I don’t think that there is an ‘if’ in the city government anymore about whether we make investments in building a structure or helping to promote technological innovation in Salinas.” “That’s unbelievable in one year to have seen such a complete shift from a community that, in Salinas’ case in particular, was very much plagued by the immediate concerns of violence prevention and keeping one or two specific jobs in place rather than expanding them over time.”
<i>Civic Group</i>	
Donohue	“I mean, think about little old Salinas... Salinians tend to suffer a little bit from, ‘What do other people think of us,’ rather than what we think of ourselves.”
Corpuz	“What’s the largest industry in the central coast, not just in Monterey County, the whole central coast? It’s agriculture by far. Nothing else touches it.” “Yet, we haven’t been able to figure out how to take that value proposition of sort of the whole industry and keep it and nurture it and grow it in Salinas.”
Weir	“One of the most serious issues we have is the lack of adequate housing...the circumstances that people have to live under, it is not safe, it is not healthy, it is depressing as all get out.”

Table 15. The Self-Image of Salinas

	<b>Marketing a New Image</b>
<i>Private Sector Group</i>	
Hartnett	"I'm kind of addressing the image of the region ...in terms of the trends in the region and why I, as an investor, or I, as a business, want to locate and move to Salinas to create jobs." "I would say most people now in the community have a fair idea, that this is the most important thing that's gonna affect a region."
Meador	"We have reached out to the vintners and growers association, we've reached out to the Farm Bureau, we've reached out to the Salinas Valley Chamber of Commerce, the city council." "I think we've almost touched every group I can imagine in our county."
Fitzgerald	"You don't want to replicate the image (of Silicon Valley), and you're not going to replicate all the technology." "What you want to do is use the tie to build up their own image, their own successes, their own capabilities based on what the core competencies of the area are.... It's not integrated circuits."
<i>Non-Profit Group</i>	
D'Arrigo	"First of all selling our message and talking about what we're doing and the importance of it was number one... now we've got to spread the base of support to a broader audience."
Thompson	"I would try and create more and better means of supporting the young families that are there and the young parents that are there." "I would find ways to be able to reach out and help them and provide more opportunities, more educational opportunities."
Fogg	"My lens, understandably, because I work in communications was primarily on how do we make this something participatory, and something that people can understand." "Trying to get this to a place where not only the internal stakeholders could all understand what we were doing, but the community at large could engage with this process and take ownership of pieces of it."
<i>Civic Group</i>	
Donohue	"My hope is, this is transformational in a lot of ways in terms of quality of life and how others see the region...so there's been a big change in the mindset." "Coming up with that smart farm moniker, understanding that we didn't invent the term, but it was the right shout-out to the tech world, the smarter city, smarter planet, that was the image we wanted to convey."
Corpuz	"We weren't selling ourselves very well to the world...it was about branding the city...in an economic development way, positioning the city not just in the state but nationally and to the extent they could do it worldwide."
Weir	"I really like the fact that we're focused on who we are, too, because any strategic effort has to be real about who you are." "You can fool others, but eventually, if you fool yourself, you fail."

Table 16. Marketing a New Image

	<b>Areas of Impact: Insights Gained</b>
<i>Private Sector Group</i>	
Hartnett	“It (the model) starts to crystalize all the pieces that we’re doing and puts, I suppose, a wire frame on the need of everything that we’ve been doing...it’s very, very helpful.” “The interconnectivity of each of these and the cause and effect, but then the overall cogs in the wheel now starting to move together and seeing how they’re working, you know, it helped me a lot in terms of really understanding.”
Meador	“We all had the strategy but we really didn’t know the effects of that strategy.” “It (the model) shows you what the clear strategy should be on all the different models and at the level of importance.”
Fitzgerald	“The instantaneous clarity...it just jumps out.” “What this did was... create a tool that says, ‘Here are those issues, opportunities, risks, rewards, capabilities that you talked about in theory, here is what we could or couldn’t do.’” “This tool would be incredibly invaluable to taking it down to the detail level.”
<i>Non-Profit Group</i>	
D’Arrigo	“I think they (the modules) added a lot of clarity.” “Now I’m realizing that for that entire model to really shift things in a major way and make a major impact, it’s going to be 15 plus years.” “If you look at the whole Steinbeck Cluster Model and based on investment, education, research... I think it’s a matter of prioritizing which one comes first and there needs to be a little probably of all three ongoing... for it to be successful.”
Thompson	“Oh my God, it (the model) has been a real eye opener.” “It just provided more clarity on things that I suspected, but didn’t necessarily have hard evidence to back it up, I just had anecdotal evidence.” “It definitely made me think more about the relationships between all of the groups and the various factors and how each affects the other and how interlocked they all are.
Fogg	“What the models have done is better clarify how all of the different elements that have been at play from the start interact with one another and how those should be prioritized.”
<i>Civic Group</i>	
Donohue	“It enhanced very specifically the value of the systems approach.” “If a picture is worth 10,000 words, this is worth 100,000, to see the model in action.” “Any pretense that you can do anything short-term is just that, a pretense.”
Corpuz	“Every action is a consequence; it could be good, it could be bad, or it can be indifferent... a good input in one area might be a bad output in another area, so it’s very interesting how they all work systemically.”
Weir	“I was surprised as to some of the complexity of the relationships, I mean the model makes it a lot easier...you kind of intuitively know that, but it really helps to have something visually to help reinforce it.”

Table 17. Insights Gained

	<b>Areas of Impact: Understanding Sub-systems within the Strategy</b>
<i>Private Sector Group</i>	
Hartnett	“(The model is) very impactful in terms of the importance of some of the investment in research versus gang violence or gang crimes, etc.” “Water was kind of like way out there in terms of so important, so that has helped me... prioritize that that is something we really need to do.” “The whole area of education, obviously high school and third level education I think is crucial, and investment in research.”
Meador	“The educational side...will help the gang violence, will create jobs, help create what we need to do and where we need to go with it, and how we need to move the community as a whole.”
Fitzgerald	“When you use the word attractiveness, it is kind of warm and fuzzy, but the model says ‘Wait a minute, there is a real fit, form, function, cost result to the word attractiveness.’” “The whole water piece of this... just jumps out...if you do not have a sustainable environment, you will not have education, you will not have attractiveness
<i>Non-Profit Group</i>	
D’Arrigo	“I didn’t realize our attractiveness was as low as it is, especially the school systems being so poor.” “That was a little bit of a shock to me, but I could certainly see why...people are not moving here and wanting to start companies here.” “The water... the de-sal (and) reclamation piece was interesting, the effect of those two pieces.”
Thompson	“Just that whole water part I had just not really considered its impact on any of this.” “It has helped to clarify the startups, how the startups can be directly affected from the number of kids that are involved in ag tech educational opportunities, where they go.”
Fogg	“(The model) supported and provided more clarity for me in my initial impression that overinvestment in startups now is not the right path, because it won’t provide the sustainable long-term growth that is needed.”
<i>Civic Group</i>	
Donohue	“It really opened my eyes to near term strategic plays that we can make... (to) really capitalize on this model... and how the community can win.” “The beauty of this is it allows water to really be in the forefront of our discussion.” “To me this STEM inoculation concept protects, it prepares (kids) for the future.”
Corpuz	“If you invest in each one, the model really helps if you understand how that can affect the total outcome... particularly in the area of Ag-Tech and education.”
Weir	“It really helped me better understand the relationships of the factors that you built in the model...how we have to deal with our education system being improved.” “The understanding that water does affect us in other ways... the importance and significance of water as (not) just an issue, but its impact...the model made it a lot clearer to me.”

Table 18. Understanding Sub-systems within the Strategy

	<b>Areas of Impact: Potential Model Applications</b>
<i>Private Sector Group</i>	
Hartnett	“It’s probably more the prioritization and then the impact of one versus the other and the interrelatedness... you can see the house that you’re trying to build, whereas, we were kind of looking at the blocks.” “We can better put the proposition on the table about why the Steinbeck Cluster is so important.” “This is a great way to project the problem out into the future to get everybody back together.”
Meador	“I would like to take this knowledge and give the business community and the city/county governments a better understanding of where they need to put their focuses.” “I would hope we can bring consensus with the group... (rather) than to just run off to try to solve one issue or one problem.”
Fitzgerald	“It (the model) is a great ‘what if’ tool, to create a new policy, a new process, a new educational model.” “On one hand it is a great decision maker tool, on the other hand it is an innovator’s tool.” “It will allow you to put... that information in front of the right people so that you can pull in your planning, your actual execution sooner... using the tool, you could justify the money.”
<i>Non-Profit Group</i>	
D’Arrigo	“Everybody should see it... I would say business owners, agriculture business owners primarily, universities, high schools.” “High schools would be really key, because I think they may not realize the impact their work (has) early on in the future of the community.”
Thompson	“These kinds of models can really have some great, far reaching impacts on the decisions that people and leaders make...about policy... they are operating with anecdotal evidence.” “The whole...marketing strategy of the cluster, to explain it to the public and the policy makers, the city council, etc., the media,”
Fogg	“Looking at the group dynamics, I can see within the next few months the possibility of things shifting again such that the investment piece is separated some from the social, educational, or research, non-profit, city, municipal piece.” “I think it (the model) absolutely would have changed the group’s priorities.”
<i>Civic Group</i>	
Donohue	“We need to get this in front of the right group of stakeholders as quickly as possible.” “Any tool that gets people to where they need to be in terms of managing expectations is really, really critical.”
Corpuz	“We can use it as a way of communicating what needs to be done and prioritizing, so we’re a little smarter in how we look at the total system...”
Weir	“This model can help people better understand not only the importance of the variables, but the interactions.” “It would help accelerate people coming together and working together.”

Table 19. Potential Model Applications



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